California High-Speed Rail Authority

San Jose to Merced Project Section

Final Environmental Impact Report/ Environmental Impact Statement

Volume I: Report

February 2022

CALIFORNIA High-Speed Rail Authority

The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being or have been carried out by the State of California pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated July 23, 2019, and executed by the Federal Railroad Administration and the State of California.

California High-Speed Rail Project

San Jose to Merced Project Section

FINAL
ENVIRONMENTAL IMPACT REPORT/
ENVIRONMENTAL IMPACT STATEMENT

VOLUME 1: REPORT

Prepared under CEQA and NEPA by:

California High-Speed Rail Authority
770 L Street, Suite 620 MS-1
Sacramento, CA 95814
Contact: Serge Stanich
916-324-1541

NEPA Cooperating Agencies:

Zachary Fancher
U.S. Army Corps of Engineers
Sacramento District
1325 J Street, Room 1350
Sacramento, CA 95814
916-557-6643

Allison Jacobson
U.S. Department of the Interior,
Bureau of Reclamation
Interior Region 10, California, Great Basin
2800 Cottage Way, MP-730
Sacramento, CA 95825
916-978-5075

Dave Navecky
Office of Environmental Analysis
Surface Transportation Board
395 E Street, SW
Washington, D.C. 20423
202-245-0294

February 2022

People with sensory disabilities may contact the Authority by phone or via the Authority website to request accessibility support.

CEQA: This document has been prepared pursuant to the California Environmental Quality Act. The California High-Speed Rail Authority is the state lead agency.

NEPA: The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being or have been carried out by the State of California pursuant to 23 U.S.C. 327 and a Memorandum of Understanding (MOU) dated July 23, 2019, and executed by the Federal Railroad Administration and the State of California. Pursuant to the MOU, the California High-Speed Rail Authority is the federal lead agency. Prior to the July 23, 2019 MOU, the FRA was the federal lead agency. Accordingly, and per the above, the Authority is both the CEQA and NEPA lead agency for this project.

California High-Speed Rail: San Jose to Merced Project Section
Final Environmental Impact Report/Environmental Impact Statement

Pursuant to:
California Environmental Quality Act (Pub. Resources Code § 21000 et seq.)
State of California CEQA Guidelines (Cal. Code Regs., Tit. 14, § 15000 et seq.)
National Environmental Policy Act (42 U.S.C. § 4321 et seq.)
40 C.F.R. Parts 1500-1508, 64 Fed. Reg. 28545, 49 U.S.C. § 303 and 23 U.S.C. § 327

Prepared by:
California High-Speed Rail Authority
770 L Street, Suite 620 MS-1
Sacramento, CA 95814
Contact: Serge Stanich
916-324-1541

NEPA Cooperating Agencies:
U.S. Army Corps of Engineers, Sacramento District
1325 J Street, Room 1350
Sacramento, CA 95814
Contact: Zachary Fancher
916-557-6643

Surface Transportation Board, Office of Environmental Analysis
395 E Street, SW
Washington, DC 20423
Contact: David Navecky
202-245-0294

U.S. Department of the Interior, Bureau of Reclamation, Mid-Pacific Region
2800 Cottage Way, MP-730
Sacramento, CA 95825
Contact: Allison Jacobson
916-978-5075

Signed by Brian P. Kelly on January 14, 2022

Brian P. Kelly
Chief Executive Officer
California High-Speed Rail Authority

Date: _____

For additional information concerning this document, contact:

Serge Stanich
Director of Environmental Services
California High-Speed Rail Authority
770 L Street, Suite 620 MS-1
Sacramento, CA 95814

February 2022

California High-Speed Rail Authority. 2022. *San Jose to Merced Project Section: Final Environmental Impact Report/ Environmental Impact Statement.* February 2022. Sacramento, CA.

Abstract: The *San Jose to Merced Project Section: Final Environmental Impact Report/Environmental Impact Statement* was prepared as a joint document to meet all pertinent requirements of both the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). Following NEPA assignment in July 2019, the California High-Speed Rail Authority has assumed the role of federal lead agency on the project. Specifically, the environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being or have been carried out by the State of California pursuant to 23 U.S.C § 327 and a Memorandum of Understanding (MOU) dated July 23, 2019, and executed by the Federal Railroad Administration (FRA) and the State of California. Prior to the July 23, 2019 MOU, the FRA was the federal lead agency. Accordingly, and per the above, the Authority is both the CEQA and NEPA lead agency for this project. Volume 4 of this Final EIR/EIS considers all comments received during the comment period for the Draft EIR/EIS and Revised Draft EIR/Supplemental Draft EIS and provides responses to those comments.

This document considers, describes, and summarizes at a project level of analysis the environmental impacts of a proposed high-speed rail (HSR) system for intercity travel between San Jose and the Central Valley of California, that connects to the larger statewide HSR system. Four end-to-end project alternatives and a no project alternative are analyzed.

Impact Avoidance and Minimization Features, along with mitigation measures, are described to guide HSR environmental review to avoid or minimize potential impacts.

Fact Sheet

Since publication of the Draft Environmental Impact Report (EIR)/Environmental Impact Statement (EIS), the following substantive changes have been made to this section.

- This section was updated to reflect publication of the Merced to Fresno Section: Central Valley Wye Final Supplemental EIR/EIS.
- The Project Description section was updated to describe the California High-Speed Rail Authority's (Authority) mitigation for impacts on emergency vehicle response time. It was also updated to describe the Final EIR/EIS certification and Record of Decision processes.
- The Document Availability section was updated to reflect that summaries of the purpose and scope of the EIR/EIS were made available online in English, Spanish, Vietnamese, and Mandarin.
- The Permits, Approvals, and Consultations section was corrected to state that the Federal Railroad Administration (FRA) is responsible for the General Conformity Determination and regulatory authority over railroad safety.
- Sections on Contact Information and Public Review Period and Next Steps applicable to the Draft EIR/EIS were deleted from the Final EIR/EIS. A Subsequent Steps section was added to the Public Release of the Final EIR/EIS section to describe steps following issuance of the Final EIR/EIS.

Project Name

California High-Speed Rail Project, San Jose to Merced Project Section

Project Description

The Authority certified a Statewide Program EIR/EIS (Tier 1) in November 2005 as the first phase of a tiered environmental review process for the proposed California High-Speed Rail (HSR) System planned to provide a reliable, high-speed, electric-powered rail system that links the major metropolitan areas of the state and that delivers predictable and consistent travel times. A further objective is to provide an interface with commercial airports, mass transit, and the highway network and to relieve capacity constraints of the existing transportation system as increases in intercity travel demand in California occur, in a manner sensitive to and protective of California's unique natural resources. A second program-level (Tier 1) EIR/EIS was completed in 2008 focusing on the connection between the Bay Area and Central Valley; the Authority revised this document under California Environmental Quality Act (CEQA) and completed in 2012. Based on the Program EIR/EISs, the Authority selected preferred corridors and station locations to advance for further study.

The Authority has prepared a project-level (Tier 2) EIR/EIS that further examines the California HSR San Jose to Merced Project Section as part of the larger, 800-mile HSR system planned throughout California. The HSR system will connect the major population centers of Sacramento, the San Francisco Bay Area, the Central Valley, Los Angeles, the Inland Empire, Orange County, and San Diego. The HSR system will use state-of-the-art, electrically powered, high-speed, steel-wheel-on-steel-rail technology, including contemporary safety, signaling, and automated train-control systems, with trains capable of operating at up to 220 miles per hour (mph) over a dedicated track alignment.

The San Jose to Merced Project Section would provide HSR service between San Jose Diridon Station in downtown San Jose and a station in downtown Merced, with a Gilroy station either in downtown Gilroy or east of Gilroy. The Project Section would allow trains in the San Francisco Bay Area to transition smoothly via the Central Valley Wye to and from the Central Valley portion of the HSR system that runs north to Merced and south to Fresno and Southern California. The Project Section comprises three project extents:

- From Scott Boulevard in Santa Clara to Carlucci Road in Merced County, at the western terminus of the Central Valley Wye (the project evaluated in this document)
- The Central Valley Wye beginning at Carlucci Road in Merced County, which connects the east-west portion of HSR from the Bay Area to the Central Valley with the north-south portion from Merced to Fresno (evaluated in the 2020 *Merced to Fresno Section: Central Valley Wye Final Supplemental EIR/EIS* (Authority 2020))
- The northernmost portion of the Merced to Fresno Project Section, from the northern limit of the Central Valley Wye (Ranch Road) to the Merced Station (evaluated in the 2012 *Merced to Fresno Section Final EIR/EIS* [Authority and FRA 2012])

The extent of the Project Section analyzed in this *San Jose to Merced Project Section Final EIR/EIS* (Final EIR/EIS) is from Scott Boulevard, just north of San Jose Diridon Station, to Carlucci Road. This is referred to as the San Jose to Central Valley Wye Project Extent (project or project extent). The project extent is located in Santa Clara, San Benito, and Merced Counties, in or near the cities of Santa Clara, San Jose, Morgan Hill, Gilroy, and Los Banos.

The approximately 90-mile project extent of the 145-mile-long Project Section comprises mostly dedicated HSR system infrastructure, HSR station locations at San Jose Diridon and Gilroy, a maintenance of way facility (MOWF) either south or southeast of Gilroy, and a maintenance of way siding (MOWS) west of Turner Island Road in the Central Valley. HSR stations at San Jose Diridon and Gilroy would provide links with regional and local mass transit services as well as connectivity to the Santa Clara County and Central Valley highway network.

The project extent comprises the following five subsections:

- **San Jose Diridon Station Approach**—Extends approximately 6 miles from north of San Jose Diridon Station at Scott Boulevard in Santa Clara to West Alma Avenue in San Jose. This subsection includes the San Jose Diridon Station.
- **Monterey Corridor**—Extends approximately 9 miles from West Alma Avenue to Bernal Way in the community of South San Jose. This subsection is entirely within the city of San Jose.
- **Morgan Hill and Gilroy**—Extends approximately 30 miles from Bernal Way in the community of South San Jose to Casa de Fruta Parkway/State Route (SR) 152 in Santa Clara County.
- **Pacheco Pass**—Extends approximately 25 miles from Casa de Fruta Parkway/SR 152 to east of Interstate (I-) 5 in unincorporated Merced County.
- **San Joaquin Valley**—Extends approximately 20 miles from I-5 to Carlucci Road in unincorporated Merced County.

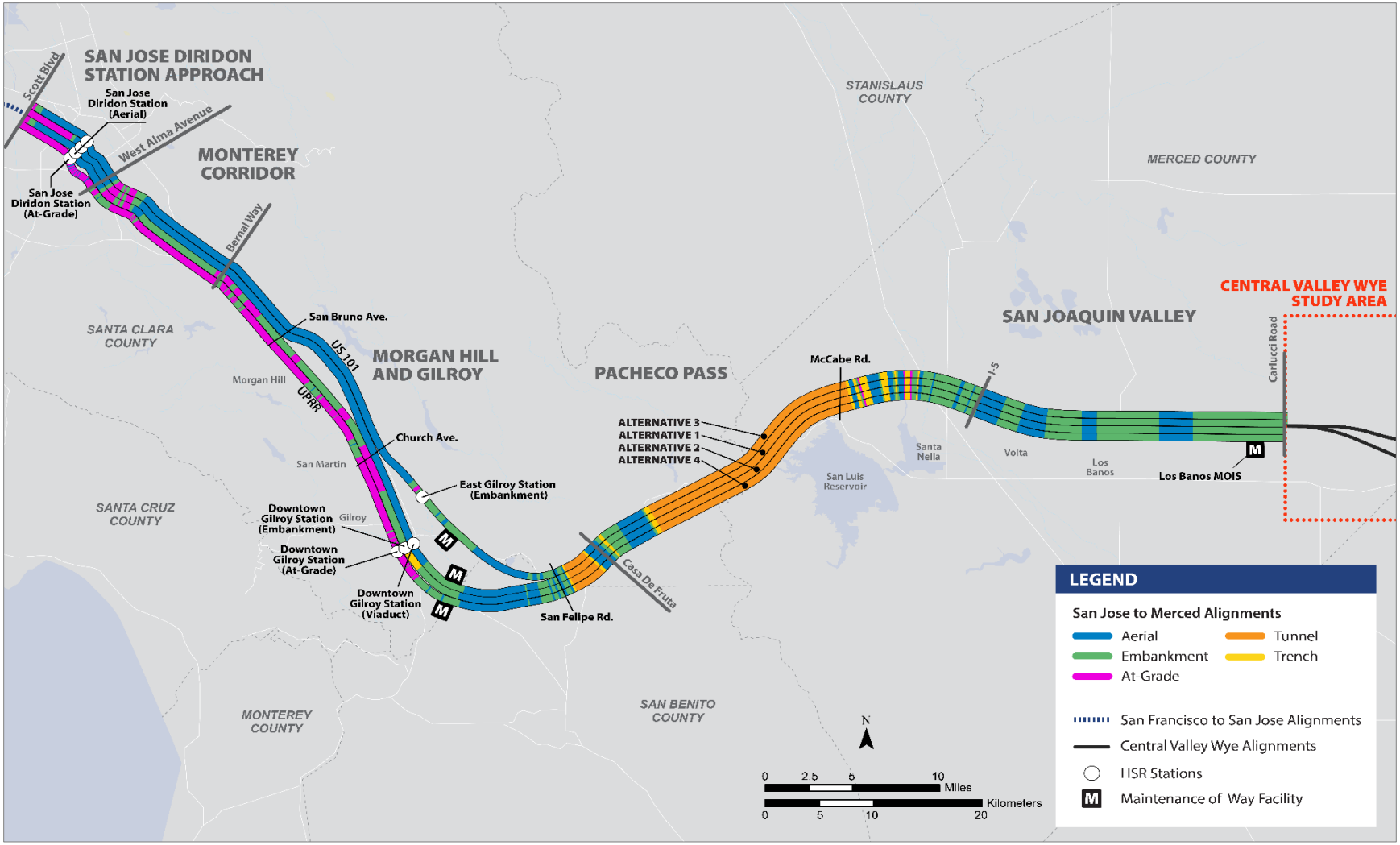
The Authority has developed four end-to-end alternatives for the project (Alternatives 1 to 4), as illustrated on Figure 1. Table 1 shows the design options of each alternative by subsection.

Table 1 San Jose to Central Valley Wye Design Options by Subsection

Subsection/Design Options	Alternative 1	Alternative 2	Alternative 3	Alternative 4
San Jose Diridon Station Approach[1]				
Viaduct to Scott Blvd	–	X	X	–
Viaduct to I-880	X	–	–	–
Blended, At-Grade	X[2]	–	–	X

Subsection/Design Options	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Monterey Corridor				
Viaduct	X	–	X	–
At-Grade	–	X	–	–
Blended, At-Grade	–	–	–	X
Morgan Hill and Gilroy				
Embankment to downtown Gilroy[3]	–	X	–	–
Viaduct to downtown Gilroy[3]	X	–	–	–
Viaduct to east Gilroy[4]	–	–	X	–
Blended, At-Grade to downtown Gilroy[3]	–	–	–	X
Pacheco Pass				
Tunnel	X	X	X	X
San Joaquin Valley				
Henry Miller Rd	X	X	X	X

[1] All four alternatives include the San Jose Diridon Station; Alternatives 1, 2, and 3 would use an elevated station; Alternative 4 would use an at-grade station.
[2] Alternative 1 is blended, at-grade from Scott Boulevard to I-880 only.
[3] Would use Downtown Gilroy Station.
[4] Would use East Gilroy Station.



JANUARY 2019

Figure 1 San Jose to Merced Project Section

This Final EIR/EIS evaluates the impacts and benefits of the four project alternatives (including stations and maintenance facilities) and the no project alternative. The four project alternatives were developed through extensive local and agency involvement, stakeholder meetings, and public and agency comments, and were subjected to a thorough screening process that considered the impacts of the alternatives on the social, natural, and built environment. Mitigation measures are proposed to reduce the severity of potential significant, adverse impacts.

The Authority's Preferred Alternative under NEPA, which serves as the proposed project for CEQA, is Alternative 4 with the inclusion of the Diridon design variant (DDV) and the tunnel design variant (TDV). The Preferred Alternative includes two stations (San Jose Diridon Station and Downtown Gilroy Station), an MOWF, an MOWS, two tunnels, the DDV and TDV, and traction power facilities. The Authority identified this alternative on the basis of a balanced consideration of the environmental information presented in the Final EIR/EIS in the context of Purpose and Need; project objectives; CEQA, the National Environmental Policy Act (NEPA), and Clean Water Act Section 404(b)(1) requirements; Section 4(f) of the Department of Transportation Act (49 U.S.C. § 303) requirements; local and regional land use plans; community preferences; and cost.

The Preferred Alternative would have lower overall impacts on community resources than the other alternatives, although it would have the most noise impacts (with noise barrier mitigation only). While the Preferred Alternative would potentially have the greatest impact on emergency vehicle response times, this could be mitigated by the Authority working with local jurisdictions to install emergency vehicle priority at traffic lights (where not already present), emergency vehicle queue bypass lanes, improvement to parallel routes, new responder equipment at existing stations to expand ability to respond to multiple calls, increase in contracted ambulance services to reduce response time, and/or construct and operate new fire stations where necessary to reduce delays above the threshold value. The Authority would also partner with local jurisdictions with significant emergency vehicle response effects to install an independent at-grade railroad crossing monitoring system connected to local police and fire dispatch to improve real-time response planning. This alternative would also result in the lowest impacts of the four project alternatives on key natural environmental factors, such as wetlands and other aquatic habitats that provide high-value habitat for a diverse array of species, and it is the alternative most likely to receive support for permitting by the U.S. Army Corps of Engineers under the Clean Water Act. The Preferred Alternative would also result in the lowest impacts from permanent use of Section 4(f) parks and built environment historic resources that are listed or eligible for listing the National Register of Historic Places. The Preferred Alternative is estimated to cost approximately $16.5 billion (in 2018 dollars)—the lowest capital cost of the four project alternatives. The Authority's Board of Directors will consider whether to formally adopt the Preferred Alternative or another project alternative as the selected alternative for the project after consideration of comments on the Draft EIR/EIS and review of and decision on certification of this Final EIR/EIS pursuant to CEQA. The Authority's Board of Directors will also consider whether to direct the Authority Chief Executive Officer to issue a Record of Decision selecting the Preferred Alternative in the Authority's role as NEPA lead agency.

NEPA Lead Agency

The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being or have been carried out by the State of California pursuant to 23 U.S.C. § 327 and a Memorandum of Understanding (MOU) dated July 23, 2019, and executed by the FRA and the State of California. Pursuant to the MOU, the Authority is the federal lead agency. Prior to the July 23, 2019 MOU, the FRA was the federal lead agency.

Responsible NEPA Official

Brian P. Kelly, Chief Executive Officer
California High-Speed Rail Authority
770 L Street, Suite 620 MS-1
Sacramento, CA 95814

CEQA Lead Agency

The Authority is the lead agency for CEQA compliance.

Responsible CEQA Official

Brian P. Kelly, Chief Executive Officer
California High-Speed Rail Authority
770 L Street, Suite 620 MS-1
Sacramento, CA 95814

Document Availability

Visit the Authority website (www.hsr.ca.gov) to view and download the Final EIR/EIS. You may also request an electronic copy of the Final EIR/EIS by calling (800) 455-8166. In addition, the Authority published materials online (in English, Spanish, Vietnamese, and Mandarin) summarizing the purpose and contents of the document. More details about availability of the Final EIR/EIS and associated technical reports can be found in the Preface of this Final EIR/EIS and in the Notice of Availability at www.hsr.ca.gov.

The San Jose to Merced Project Section EIR/EIS is a second-tier EIR/EIS that tiers off of two first-tier program EIR/EIS documents and provides project-level information for decision making on this portion of the HSR system. The Authority and the FRA prepared the 2005 *Final Program EIR/EIS for the Proposed California High-Speed Train System* (Authority and FRA 2005), which provided a first-tier analysis of the general effects of implementing the HSR system across two-thirds of the state. The 2008 *Bay Area to Central Valley High-Speed Train Final Program EIR/EIS* (Authority and FRA 2008) and the Authority's 2012 *Bay Area to Central Valley High-Speed Train Partially Revised Final Program EIR* (Authority 2012) were also first-tier programmatic documents, but they focused on the Bay Area to Central Valley region. The first-tier EIR/EIS documents provided the Authority and FRA with the environmental analyses necessary to evaluate the overall HSR system and make broad decisions about general HSR alignments and station locations for further study in the second-tier EIR/EISs.

Electronic copies of the Tier 1 documents are available on request by calling the Authority office at (800) 455-8166. The Tier 1 documents may also be reviewed at the Authority's offices during business hours at 770 L Street, Suite 620 MS-1, Sacramento, CA 95814 and 100 Paseo de San Antonio, Suite 300, San Jose, CA 95113.

Electronic copies of the Merced to Fresno Final EIR/EIS and the Merced to Fresno Central Valley Wye Final Supplemental EIR/EIS are available on request to the Authority by calling (800) 455-8166. The Merced to Fresno Central Valley Wye Final Supplemental EIR/EIS is also available on the Authority website at www.hsr.ca.gov. These documents are not currently part of the public review; however, they are available for review and reference and can also be viewed during business hours at 770 L Street, Suite 620 MS-1, Sacramento, CA 95814 and 100 Paseo de San Antonio, Suite 300, San Jose, CA 95113.

Permits, Approvals, and Consultations

Federal

- **U.S. Army Corps of Engineers**—Clean Water Act Section 404 permit for discharge of dredge or fill materials into waters of the U.S., including wetlands. Also, Section 14 of the Rivers and Harbors Act of 1899 (Section 408) permission to alter or modify a facility or feature of any federally regulated flood control system.
- **U.S. Department of the Interior, Bureau of Reclamation**—Encroachment permit; use permit.
- **U.S. Department of Transportation/Federal Railroad Administration**—(acting through the Authority under the July 23, 2019 NEPA Assignment MOU): Section 4(f) of the U.S.

Transportation Act of 1966 evaluation; General Conformity Determination under the Clean Air Act; regulatory authority over railroad safety.

- **U.S. Department of the Interior/National Park Service**—Section 6(f) of the Land and Water Conservation Fund Act of 1965 evaluation.
- **U.S. Advisory Council on Historic Preservation and the California State Historic Preservation Office**—Section 106 consultation (National Historic Preservation Act of 1966) and memorandum of agreement.
- **U.S. Environmental Protection Agency**—Review of the EIS under Clean Air Act Section 309; review of Environmental Justice conclusions.
- **U.S. Fish and Wildlife Service**—Section 7 consultation and biological opinion/incidental take statement pursuant to the Endangered Species Act of 1973.
- **National Marine Fisheries Service**—Section 7 consultation and biological opinion/incidental take statement pursuant to the Endangered Species Act of 1973.
- **Surface Transportation Board**—Authority to construct and operate a new rail line.
- **Federal Emergency Management Agency**—Conditional Letter of Map Revision; Letter of Map Revision; No-Rise Certification for floodways.
- **Natural Resources Conservation Service**—Watershed and Flood Prevention Operations Program review for modifications to levees along Llagas Creek (Alternative 3 only).

State

- **California Department of Fish and Wildlife**—Incidental take permit under Section 2081 of the California Fish and Game Code; California Fish and Game Code Section 1600 et seq. lake and streambed alteration agreement.
- **California Department of Transportation**—Encroachment permits.
- **California Public Utilities Commission**—Approval for construction and operation of railroad crossing of public roads and ministerial Notice of Construction or discretionary Permit to Construct associated with network upgrades to PG&E facilities.
- **California State Historic Preservation Office**—Section 106 consultation (National Historic Preservation Act of 1966).
- **California State Lands Commission**—Lease for crossing state sovereign lands.
- **State Water Resources Control Board, Central Valley Regional Water Quality Control Board and San Francisco Bay Regional Water Quality Control Board** —Section 401 Water Quality Certification under the Clean Water Act of 1972; Construction General Permit (Order No. Order 2009-0009-DWQ); Industrial General Permit (Order No. 2014-0057-DWQ); Caltrans Statewide MS4 Permit (Order No. 2012-0011-DWQ); Phase I Municipal Separate Storm Sewer System (MS4)/Municipal Regional Permit (Order No. R2-2015-0049); Phase II MS4 Permit (Order No. 2013-0001-DWQ); VOC and Fuel General Permit (Order No. R2-2012-0012); Groundwater General Permit (Order No. R2-2012-0060); Discharges with Low Threat to Water Quality (Order No. R3-2011-0223); Dewatering and Other Low Threat Discharges (Order No. R5-2013-0074); spill prevention, control, and countermeasure (SPCC) plan (part of Section 402 process); stormwater construction and operation permit.
- **California Department of Water Resources**—Encroachment permit.

Regional

- **San Joaquin Valley Air Pollution Control District**—Permits under Rule 201 General Permit Requirements, Rule 403 Fugitive Dust, Rule 442 Architectural Coatings, Rule 902 Asbestos, and Rule 9510 Indirect Source Review.

- **Bay Area Air Quality Management District**—Permits under Rule 201 General Permit Requirements, Rule 403 Fugitive Dust, Rule 442 Architectural Coatings, Rule 902 Asbestos, and Rule 9510 Indirect Source Review.
- **Monterey Bay Air Resources District**—Permits under Rule 201 General Permit Requirements, Rule 403 Fugitive Dust, Rule 442 Architectural Coatings, Rule 902 Asbestos, and Rule 9510 Indirect Source Review.

Authors and Principal Contributors

Chapter 11, List of Preparers, contains a complete list of the persons involved in preparation of the Final EIR/EIS.

Public Release of Final EIR/EIS

February 11, 2022

Subsequent Steps

Following issuance of this Final EIR/EIS, the Authority's Board of Directors will hold a board meeting to consider whether to certify the Final EIR/EIS and approve the Preferred Alternative pursuant to CEQA. The Authority's Board of Directors will also consider whether to direct the Authority Chief Executive Officer to issue a Record of Decision for the San Jose to Merced Project Section selecting the Preferred Alternative in the Authority's role as NEPA lead agency.

Preface

What Is This Document?

The California High-Speed Rail Authority (Authority) proposes to construct, operate, and maintain an electric-powered high-speed rail (HSR) system in California. When completed, the 800-mile HSR system will provide new passenger rail service to California's major metropolitan areas and through the counties that are home to more than 90 percent of the state's population. The approximately 145-mile-long San Jose to Merced Project Section (Project Section) would provide the public with electric-powered HSR service that provides predictable and consistent travel times between major urban centers and connectivity to airports, mass transit systems, and the highway network stretching from Santa Clara County in the San Francisco Bay Area to the Central Valley. It would help connect the northern and southern portions of the statewide HSR system. The Project Section would provide HSR service between Diridon Station in downtown San Jose and a station in downtown Merced. The Project Section comprises three project extents:

- From Scott Boulevard in Santa Clara to Carlucci Road in Merced County, at the western terminus of the Central Valley Wye (the project evaluated in this document)
- The Central Valley Wye, which connects the east-west portion of HSR from the Bay Area to the Central Valley, beginning at Carlucci Road in Merced County, with the north-south portion from Merced to Fresno (evaluated in the 2020 *Merced to Fresno Section: Central Valley Wye, Final Supplemental Environmental Impact Report [EIR]/Environmental Impact Statement [EIS]* (Authority 2020))
- The northernmost portion of the Merced to Fresno Project Section, from the northern limit of the Central Valley Wye (Ranch Road) to the Merced Station (evaluated in the 2012 *Merced to Fresno Section Final EIR/EIS* [Authority and FRA 2012])

The portion of the Project Section analyzed in this *San Jose to Merced Project Section Final EIR/EIS* (Final EIR/EIS) is from Scott Boulevard, just north of San Jose Diridon Station, to Carlucci Road. This is referred to as the San Jose to Central Valley Wye Project Extent (project or project extent). It would extend approximately 90 miles, passing through Santa Clara, San Benito, and Merced Counties and in or near the cities of Santa Clara, San Jose, Morgan Hill, Gilroy, and Los Banos. Four project alternatives and the no project alternative are analyzed in this joint California Environmental Quality Act (CEQA)/National Environmental Policy Act (NEPA) document.

Pursuant to 23 United States Code (U.S.C.) Section 327, under the NEPA Assignment Memorandum of Understanding between the Federal Railroad Administration (FRA) and the State of California, effective July 23, 2019, the Authority is the project sponsor and the lead federal agency for compliance with NEPA and other federal laws for the California HSR System, including the San Jose to Merced Project Section. The Authority is also the state lead agency under CEQA.

The Council on Environmental Quality provides for NEPA decision making through a phased process (42 U.S.C. § 4321 et seq.; 40 Code of Federal

Sequence of Associated California HSR Tiered Environmental Documents

Tier 1/Program Documents

- Final Program EIR/EIS for the Proposed California High-Speed Train System (2005)
- San Francisco Bay Area to Central Valley High-Speed Train Final Program EIR/EIS (2008)
- Bay Area to Central Valley High-Speed Train Partially Revised Final Program EIR (2012)

Tier 2/Project Documents

- Merced to Fresno Section Final EIR/EIS (2012)
- Merced to Fresno Section: Central Valley Wye Final Supplemental EIR/EIS (2020)
- San Francisco to San Jose Section Draft EIR/EIS (2020)
- San Jose to Merced Project Section Final EIR/EIS (this document)

Regulations (C.F.R.) § 1502.20)[1] known as *tiering*. This phased process supports a broad-level programmatic decision using a first-tier EIS. The first-tier process is followed by more specific decisions at the second tier, with one or more second-tier EISs. The NEPA tiering process allows incremental decision making for large projects that would be too extensive and cumbersome to analyze in one traditional project EIS. CEQA (Public Resources Code § 21000 et seq.) also encourages tiering and provides for first-tier and second-tier EIRs.

The San Jose to Merced Project Section EIR/EIS is a second-tier EIR/EIS that tiers off of first-tier program EIR/EIS documents and provides project-level information for decision making on this portion of the HSR system. The Authority and the FRA prepared the 2005 *Final Program EIR/EIS for the Proposed California High-Speed Train System* (Authority and FRA 2005), which provided a first-tier analysis of the general effects of implementing the HSR system across two-thirds of the state. The 2008 *Bay Area to Central Valley High-Speed Train Final Program EIR/EIS* (Authority and FRA 2008) and the Authority's 2012 *Bay Area to Central Valley High-Speed Train Partially Revised Final Program EIR* (Authority 2012) were also first-tier programmatic documents, but they focused on the Bay Area to Central Valley region. These first-tier EIR/EIS documents provided the Authority and FRA with the environmental analyses necessary to evaluate the overall HSR system and make broad decisions about general HSR alignments and station locations for further study in the second-tier EIR/EISs. Between San Jose and Merced, the corridor advanced for Tier 2 study was the Pacheco Pass via Henry Miller Road from San Jose to the Central Valley. The station locations advanced for Tier 2 study were in San Jose and Gilroy with no station between Gilroy and Merced.

The San Jose to Merced Project Section EIR/EIS analyzes the environmental impacts and benefits of implementing the HSR in the more geographically limited area between San Jose Diridon Station and Carlucci Road and is based on more detailed project planning and engineering. The analysis therefore builds on the earlier decisions and program EIR/EISs and provides more site-specific and detailed analysis.

This Final EIR/EIS does the following:

- Describes four project alternatives and their potential impacts
- Provides environmental information to assist decision makers in selecting the project alternative to be built
- Identifies measures to avoid and minimize impacts and, when necessary, to compensate for adverse impacts
- Considers cumulative impacts as part of the environmental review process

The Authority widely circulated the Draft EIR/EIS to affected local jurisdictions, state and federal agencies, tribes, community organizations, other interest groups, and interested individuals. The document was also made available at Authority offices, public libraries, and county clerk offices (refer to Chapter 10, Distribution List, for a complete list of repository locations). The Draft EIR/EIS was made available to the public by the Authority in accordance with its responsibility as the federal lead agency for review and comment, as required, for a minimum of 45 days pursuant to CEQA and NEPA. During this period, the Authority hosted a public hearing and community open houses. The public hearing provided an opportunity for the public to submit verbal comments on the Draft EIR/EIS and the alternatives under consideration. Written comments were also accepted at the open houses and the hearing.

This document, the San Jose to Merced Project Section Final EIR/EIS, incorporates the whole of the Draft EIR/EIS. Volume 4 of this Final EIR/EIS includes the Authority's responses to all

[1] The Council on Environmental Quality (CEQ) issued new regulations, effective September 14, 2020, updating the NEPA implementing procedures at 40 C.F.R. Parts 1500–1508. However, because this project initiated the NEPA process before September 14, 2020, it is not subject to the new regulations. The Authority is relying on the regulations as they existed prior to September 14, 2020. Therefore, all citations to CEQ regulations in this environmental document refer to the 1978 regulations, pursuant to 40 C.F.R. Section 1506.13 (2020) and the preamble at 85 *Federal Register* 43340.

comments received during the public circulation of the Draft EIR/EIS and the Revised/Supplemental Draft EIR/EIS, while Volumes 1 and 2 have been revised to reflect changes and clarifications, including those based on comments received. These revisions are described in greater detail in the Final EIR/EIS Executive Summary.

The Authority is issuing this document in February 2022, prior to an anticipated meeting of the Authority's Board, further described below. The document will be available electronically on the Authority's website; the Authority will also distribute electronic copies to interested parties. The Authority will make copies of the document available for public review at the Authority's Sacramento and San Jose offices, and at various local library facilities during hours the facilities are open (open days/hours may be reduced for compliance with coronavirus public health and safety directives).

How Do I Use This Document?

The purpose of environmental documents prepared under NEPA and CEQA is to disclose information about a proposed project to decision makers and the public. While the science and analysis that supports this Final EIR/EIS are complex, this document is intended for the general public. Every attempt has been made to limit the use of technical terms and acronyms. Where this cannot be avoided, the terms and acronyms are defined the first time they are used in each chapter. This San Jose to Merced Project Section Final EIR/EIS has been prepared in accordance with Section 508 of the Rehabilitation Act of 1973, as amended, and the Web Content Accessibility Guidelines, as required under Section 11546.7 of the California Government Code, and can be found on the Authority's website.

Volume 1 of this Final EIR/EIS is organized into 15 chapters and an Executive Summary. Translated versions of the Executive Summary are available in Spanish, Mandarin, and Vietnamese. Volume 2 contains technical appendices. Throughout Volumes 1 and 2, to the extent practical and for the convenience of the reader, a vertical line in the left- and right-hand margins indicate areas where substantive edits to text, tables, or graphics were made between the Draft EIR/EIS and the Final EIR/EIS. Minor editorial changes and clarifications are not identified. In addition, substantive changes are summarized at the beginning of each chapter and resource topic section of Chapter 3. Volume 3 provides plans and other relevant engineering drawings and includes any changes since publication of the Draft EIR/EIS. Volume 4 is newly added and includes responses to comments received on the Draft EIR/EIS and the *San Jose to Merced Project Section Revised Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement, Biological Resources Analysis* (Revised/Supplemental Draft EIR/EIS). For a reader with limited time to devote to this document, the Executive Summary is the place to start. It provides an overview of all of the substantive chapters in this document, includes a table listing the potential environmental impacts for each environmental resource topic, and summarizes the substantive changes in each section since publication of the Draft EIR/EIS. If the reader begins here but wants more information, the Executive Summary directs the reader to more detailed discussion elsewhere in the document. Below is a list of the chapters and a short summary of each.

Chapter 1, Project Purpose, Need, and Objectives, explains the project purpose and need for the San Jose to Merced Project Section, provides a history of the planning process, and describes the project's relationship to other plans, programs, and transportation projects.

Chapter 2, Alternatives, describes in detail the four project alternatives and the no project alternative that the Authority is considering in this Final EIR/EIS. It contains illustrations and maps and provides a review of construction activities. These first two chapters help the reader understand what is being analyzed in the remainder of the document.

Chapter 3, Affected Environment, Environmental Consequences, and Mitigation Measures, is where the reader can find information about the existing transportation, environmental, and social conditions in the project area. This chapter provides the findings of the analysis of potential

environmental impacts, along with methods to reduce these impacts (called mitigation measures). Chapter 3 is divided into the following sections:

- Section 3.1, Introduction
- Section 3.2, Transportation*
- Section 3.3, Air Quality and Greenhouse Gases*
- Section 3.4, Noise and Vibration*
- Section 3.5, Electromagnetic Fields and Electromagnetic Interference
- Section 3.6, Public Utilities and Energy
- Section 3.7, Biological and Aquatic Resources*
- Section 3.8, Hydrology and Water Resources*
- Section 3.9, Geology, Soils, Seismicity, and Paleontological Resources*
- Section 3.10, Hazardous Materials and Wastes*
- Section 3.11, Safety and Security
- Section 3.12, Socioeconomics and Communities*
- Section 3.13, Station Planning, Land Use, and Development
- Section 3.14, Agricultural Farmland*
- Section 3.15, Parks, Recreation, and Open Space
- Section 3.16, Aesthetics and Visual Quality*
- Section 3.17, Cultural Resources*
- Section 3.18, Regional Growth
- Section 3.19, Cumulative Impacts

*separate technical report available

Chapter 4, Section 4(f)/6(f) Evaluation, provides the analysis to support the Authority's preliminary determinations to comply with the provisions of Section 4(f) of the Department of Transportation Act of 1966 and Section 6(f) of the Land and Water Conservation Funds Act.

Chapter 5, Environmental Justice, discusses whether the project alternatives would have a disproportionately high and adverse effect on minority populations and/or low-income populations.

Chapter 6, Project Costs and Operations, summarizes the estimated costs for building, operating, and maintaining each of the project alternatives evaluated in this Final EIR/EIS.

Chapter 7, Other CEQA/NEPA Considerations, summarizes the unavoidable adverse effects under NEPA, the significant and unavoidable impacts under CEQA, the relationship between short-term uses of the environment and long-term productivity, and the significant irreversible or irretrievable commitments of resources that would result from the project alternatives.

Chapter 8, Preferred Alternative, describes the Preferred Alternative and the basis for identifying it.

Chapter 9, Public and Agency Involvement, describes the public and agency involvement efforts conducted for the preparation of this Final EIR/EIS.

Chapter 10, Distribution List, identifies the public agencies, tribes, and organizations that were informed of the availability of, and locations to review, this Final EIR/EIS.

Chapter 11, List of Preparers, provides the names and roles of the preparers of this Final EIR/EIS.

Chapter 12, References, lists the references used in writing this document.

Chapter 13, Glossary of Terms, provides a definition of certain terms used in this Final EIR/EIS.

Chapter 14, Index, provides a tool to cross-reference major topics in this Final EIR/EIS.

Chapter 15, Acronyms and Abbreviations, defines the acronyms and abbreviations used in this document.

Volume 2, Technical Appendices, provides additional details on the project alternatives; the Final EIR/EIS process; and resource-specific background information, data, and other evidence supporting the analyses. Technical appendices are primarily related to the affected environment and environmental consequences analyses. These appendices are numbered to match their corresponding section in Chapter 3, as well as Chapter 2, of this Final EIR/EIS (e.g., 3.7-A is the first appendix for Section 3.7, Biological and Aquatic Resources).

Volume 3, Preliminary Engineering for Project Design Record, presents the design drawings, including trackway and roadway crossing designs.

Volume 4, Responses to Comments on Draft Environmental Impact Report/Environmental Impact Statement, provides a list of all commenters on the Draft EIR/EIS and Revised/Supplemental Draft EIR/EIS, reproductions of the original written comments, and responses to the comments. The responses are organized into chapters based on commenter type. In addition, this volume provides the Authority's Standard Responses that address the most frequently raised issues. Translations of the Standard Responses are also available in Spanish, Mandarin, and Vietnamese.

The **Technical Reports** provide more detailed technical analyses and data on some of the environmental resources evaluated in Chapter 3. Technical reports are not part of the Final EIR/EIS—with the exception of the technical reports for Air Quality and Greenhouse Gases and Noise and Vibration, which are included in Volume 2—but are available upon request. For information on how to access and review technical reports, please refer to the Authority's website (www.hsr.ca.gov) or call (800) 455-8166.

Printed copies of the Executive Summary and Volume 1 of the Final EIR/EIS and/or electronic versions of the entire EIR/EIS (Volumes 1–4) are also available for review during business hours at the following locations (open days/hours may be reduced for compliance with coronavirus public health and safety directives):

- Authority's Northern California Regional Office: 100 Paseo de San Antonio, Suite 300, San Jose, CA 95113
- Authority's Headquarters: 770 L Street, Suite 620 MS-1, Sacramento, CA
- Central Park Library: 2635 Homestead Road, Santa Clara, CA 95051
- Dr. Martin Luther King, Jr. Library: 150 E. San Fernando Street, San Jose, CA 95112
- Gilroy Library: 350 W. 6th Street, Gilroy, CA 95020
- Los Banos Branch Library: 1312 7th Street, Los Banos, CA 93635
- Merced County Library: 2100 O Street, Merced, CA 95340
- Merced County Clerk: 2222 M Street, Merced, CA 95340
- Morgan Hill City Hall, Development Services Department, 17575 Peak Avenue, Morgan Hill, CA 95037
- Morgan Hill Library: 660 W. Main Ave, Morgan Hill, CA 95037
- San Benito County Recorder: 440 5th Street #206, Hollister, CA 95023

What Happens Next?

The Authority will consider certifying the Final EIR/EIS for compliance with CEQA and making a final decision on selecting the Preferred Alternative. If the Authority certifies the Final EIR/EIS and makes a decision on the Preferred Alternative, it will file a Notice of Determination with the State Clearinghouse. Pursuant to its responsibilities under NEPA as assigned by the FRA, the Authority would consider whether to issue a Record of Decision. The Record of Decision would describe the project and alternatives considered; describe the selected alternative; make environmental findings and determinations as may be required by the Endangered Species Act, Section 106 of

the National Historic Preservation Act, Section 4(f) of the Department of Transportation Act of 1966, and environmental justice pursuant to U.S. Presidential Executive Order 12898; and describe required mitigation measures. Separately, the FRA would make findings and determinations with regard to air quality conformity under the federal Clean Air Act.

TABLE OF CONTENTS

Volume I: Report

SUMMARY S-1
S.1 Introduction and Background S-3
S.1.1 Modifications Since the Draft EIR/EIS S-6
S.2 Tiered Environmental Review: Final Statewide Program EIR/EIS and San Jose to Merced Project Section EIR/EIS S-15
S.3 Issues Raised during the Scoping Process S-16
S.4 Purpose of and Need for the HSR System and the San Jose to Merced Project Section S-18
S.4.1 Purpose of the High-Speed Rail System S-18
S.4.2 Purpose of the San Jose to Merced Project Section S-18
S.4.3 CEQA Project Objectives for the High-Speed Rail System in California and in the San Jose to Merced Project Section S-18
S.4.4 Statewide and Regional Need for the High-Speed Rail System Statewide and in the San Jose to Merced Project Section S-19
S.5 Alternatives S-19
S.5.1 No Project Alternative S-20
S.5.2 San Jose to Merced Project Section Alternatives S-20
S.5.3 Station Area Development S-25
S.5.4 Maintenance Facilities S-25
S.6 Impact Avoidance and Minimization Features S-25
S.7 No Project Alternative Impacts S-29
S.8 HSR Alternatives Evaluation S-30
S.8.1 HSR Benefits S-31
S.8.2 Adverse Effects Common to All Alternatives S-32
S.8.3 Comparison of Impacts for the Project Alternatives S-32
S.8.4 Comparison of HSR Stations S-79
S.8.5 Comparison of Maintenance Facilities S-79
S.8.6 CEQA Summary of Impacts and Mitigation S-79
S.8.7 Capital and Operations Cost S-110
S.9 Section 4(f) and Section 6(f) S-110
S.9.1 Section 4(f) S-110
S.9.2 Section 6(f) S-111
S.10 Environmental Justice S-112
S.11 Areas of Controversy S-113
S.12 Environmental Process S-113
S.12.1 Identification of Preferred Alternative S-114
S.13 Next Steps in the Environmental Process S-119
S.13.1 California High-Speed Rail Authority Decision-Making S-119
S.13.2 Federal Railroad Administration Decision-Making S-119
S.13.3 U.S. Army Corps of Engineers Decision-Making S-120
S.13.4 Surface Transportation Board S-120
S.13.5 Project Implementation S-120

1 PROJECT PURPOSE, NEED, AND OBJECTIVES 1-1
1.1 Introduction 1-2
1.1.1 The High-Speed Rail System 1-2

1.1.2 The Decision to Develop a Statewide High-Speed Rail System 1-4
1.1.3 Implementation of the Statewide High-Speed Rail System 1-5
1.1.4 The San Jose to Merced Project Section 1-10
1.1.5 Lead Agencies, Cooperating Agencies, and Responsible Agencies 1-11
1.1.6 Compatibility with Federal Transportation Policy 1-12
1.2 Purpose of and Need for the High-Speed Rail System and the San Jose to Merced Project Section 1-13
1.2.1 Purpose of the High-Speed Rail System 1-13
1.2.2 Purpose of the San Jose to Merced Project Section 1-13
1.2.3 CEQA Project Objectives of the High-Speed Rail System in California and in the San Jose to Merced Project Section Area 1-14
1.2.4 Statewide and Regional Need for the High-Speed Rail System in the San Jose to Merced Project Section Area 1-14
1.3 Relationship to Other Agency Plans, Policies, and Programs 1-33
1.3.1 California Transportation Plan 2040 1-33
1.3.2 Plan Bay Area 2040 1-33
1.3.3 San Francisco Bay Area Regional Rail Plan 1-34
1.3.4 Authority Agreements with Peninsula Corridor Joint Powers Board and Other Agencies Regarding Blended Service in the Caltrain Corridor 1-34
1.3.5 Caltrain Strategic Plan 2015–2024 1-36
1.3.6 On the Move—San Benito Regional Transportation Plan (2018–2040) 1-36
1.3.7 San Joaquin Valley Blueprint Roadmap Summary 1-36
1.3.8 San Joaquin Corridor Strategic Plan 1-37
1.3.9 Regional Transportation Plan and Sustainable Communities Strategy for Merced County 1-37
1.3.10 Madera County Transportation Commission 2018 Regional Transportation Plan 1-38
1.3.11 ACE Extension Lathrop to Ceres/Merced 1-38
1.3.12 Valley Link 1-38
1.3.13 Capitol Corridor 2014 Vision Plan Update 1-39
1.3.14 Bay Area Rapid Transit Vision Update 1-39
1.3.15 San Jose International Airport Master Plan 1-39
1.3.16 Oakland International Airport 1-40
1.4 Relationship to Other Transportation Projects in the Study Area 1-40
1.4.1 Caltrain Modernization Program 1-40
1.4.2 Caltrain South Terminal Phases II and III 1-41
1.4.3 Bay Area Rapid Transit Silicon Valley Extension 1-41
1.4.4 Silicon Valley Express Lanes 1-41
1.4.5 ACE Extension Lathrop to Ceres/Merced 1-41
1.4.6 Valley Link 1-42
1.4.7 San Jose International Airport Automated People Mover Connector 1-42
1.4.8 Bus Rapid Transit 1-42
1.4.9 Double-Track Segments of the Caltrain Line between San Jose and Gilroy 1-42
1.4.10 Monterey County Rail Extension 1-42

2 ALTERNATIVES 2-1
2.1 Introduction 2-2
2.2 Independent Utility 2-7
2.3 Background 2-7
2.4 HSR System Infrastructure 2-7
2.4.1 System Design Performance, Safety, and Security 2-8
2.4.2 Vehicles 2-9
2.4.3 Stations 2-11
2.4.4 Infrastructure Components 2-14
2.4.5 Grade Separations 2-21
2.4.6 At-Grade Crossings 2-25
2.4.7 Traction Power Distribution 2-27
2.4.8 Network Upgrades 2-31
2.4.9 Signaling and Train-Control Elements 2-31
2.4.10 Track Structure 2-32
2.4.11 Maintenance Facilities 2-32
2.5 Alternatives Considered during Alternatives Screening Process 2-33
2.6 Alignments, Station Sites, and Maintenance Facilities Evaluated in this Final EIR/EIS 2-40
2.6.1 No Project Alternative—Planned Improvements 2-40
2.6.2 San Jose to Central Valley Wye Project Alternatives 2-50
2.7 Ridership 2-136
2.7.1 Travel Demand and Ridership Forecasts 2-136
2.7.2 Ridership and HSR System Design 2-137
2.7.3 Ridership and Environmental Impact Analysis 2-138
2.7.4 Ridership and Station Area Parking 2-138
2.8 Operations and Service Plan 2-140
2.8.1 HSR Service 2-140
2.8.2 Maintenance Activities 2-141
2.9 Additional High-Speed Rail Development Considerations 2-143
2.9.1 High-Speed Rail, Land Use Patterns, and Development Around High-Speed Rail Stations 2-143
2.9.2 Right-of-Way Acquisition for Construction, Operations, and Maintenance of High-Speed Rail 2-143
2.10 Construction Plan 2-144
2.10.1 General Approach 2-145
2.10.2 Pre-Construction Activities 2-148
2.10.3 Major Construction Activities 2-154
2.11 Permits 2-165

3 AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES, AND MITIGATION MEASURES 3.1-1
3.1 Introduction 3.1-1
3.1.1 Federal and State Regulatory Context 3.1-1
3.1.2 State and Regional Policy Context 3.1-2
3.1.3 Changes between the Draft EIR/EIS and This Final EIR/EIS 3.1-3
3.1.4 Chapter 3 Purpose 3.1-3
3.1.5 Chapter 3 Organization 3.1-5
3.1.6 Chapter 3 Content 3.1-5
3.1.7 Outreach to Local Agencies 3.1-15
3.1.8 Legal Authority to Implement Off-Site Mitigation 3.1-15

3.2 Transportation 3.2-1
3.2.1 Introduction 3.2-3
3.2.2 Laws, Regulations, and Orders 3.2-4
3.2.3 Consistency with Plans and Laws 3.2-7
3.2.4 Methods for Evaluating Impacts 3.2-8
3.2.5 Affected Environment 3.2-20
3.2.6 Environmental Consequences 3.2-46
3.2.7 Mitigation Measures 3.2-103
3.2.8 Impact Summary for NEPA Comparison of Alternatives 3.2-117
3.2.9 CEQA Significance Conclusions 3.2-130
3.3 Air Quality and Greenhouse Gases 3.3-1
3.3.1 Introduction 3.3-2
3.3.2 Laws, Regulations, and Orders 3.3-4
3.3.3 Consistency with Plans and Laws 3.3-12
3.3.4 Methods for Evaluating Impacts 3.3-13
3.3.5 Affected Environment 3.3-31
3.3.6 Environmental Consequences 3.3-48
3.3.7 Mitigation Measures 3.3-102
3.3.8 Impact Summary for NEPA Comparison of Alternatives 3.3-105
3.3.9 CEQA Significance Conclusions 3.3-113
3.4 Noise and Vibration 3.4-1
3.4.1 Introduction 3.4-2
3.4.2 Laws, Regulations, and Orders 3.4-6
3.4.3 Consistency with Plans and Laws 3.4-11
3.4.4 Methods for Evaluating Impacts 3.4-12
3.4.5 Affected Environment 3.4-28
3.4.6 Environmental Consequences 3.4-37
3.4.7 Mitigation Measures 3.4-90
3.4.8 Impact Summary for NEPA Comparison of Alternatives 3.4-125
3.4.9 CEQA Significance Conclusions 3.4-132
3.5 Electromagnetic Fields and Electromagnetic Interference 3.5-1
3.5.1 Introduction 3.5-1
3.5.2 Laws, Regulations, and Orders 3.5-6
3.5.3 Consistency with Plans and Laws 3.5-10
3.5.4 Methods for Evaluating Impacts 3.5-11
3.5.5 Affected Environment 3.5-15
3.5.6 Environmental Consequences 3.5-30
3.5.7 Mitigation Measures 3.5-42
3.5.8 Impact Summary for NEPA Comparison of Alternatives 3.5-42
3.5.9 CEQA Significance Conclusions 3.5-47
3.6 Public Utilities and Energy 3.6-1
3.6.1 Introduction 3.6-3
3.6.2 Laws, Regulations, and Orders 3.6-5
3.6.3 Consistency with Plans and Laws 3.6-10
3.6.4 Methods for Evaluating Impacts 3.6-11
3.6.5 Affected Environment 3.6-18
3.6.6 Environmental Consequences 3.6-51
3.6.7 Mitigation Measures 3.6-92
3.6.8 Impact Summary for NEPA Comparison of Alternatives 3.6-94
3.6.9 CEQA Significance Conclusions 3.6-100

3.7 Biological and Aquatic Resources 3.7-1
3.7.1 Introduction 3.7-4
3.7.2 Laws, Regulations, and Orders 3.7-11
3.7.3 Consistency with Plans and Laws 3.7-16
3.7.4 Consultation with Regulatory Agencies for Federal Endangered Species Act Compliance 3.7-16
3.7.5 Methods for Evaluating Impacts 3.7-17
3.7.6 Affected Environment 3.7-35
3.7.7 Environmental Consequences 3.7-62
3.7.8 Mitigation Measures 3.7-151
3.7.9 Impact Summary for NEPA Comparison of Alternatives 3.7-206
3.7.10 CEQA Significance Conclusions 3.7-233
3.7.11 Federal Endangered Species Act Findings 3.7-278
3.8 Hydrology and Water Resources 3.8-1
3.8.1 Introduction 3.8-3
3.8.2 Laws, Regulations, and Orders 3.8-4
3.8.3 Consistency with Plans and Laws 3.8-11
3.8.4 Methods for Evaluating Impacts 3.8-12
3.8.5 Affected Environment 3.8-20
3.8.6 Environmental Consequences 3.8-43
3.8.7 Mitigation Measures 3.8-121
3.8.8 Impact Summary for NEPA Comparison of Alternatives 3.8-131
3.8.9 CEQA Significance Conclusions 3.8-141
3.9 Geology, Soils, Seismicity and Paleontological Resources 3.9-1
3.9.1 Introduction 3.9-1
3.9.2 Laws, Regulations, and Orders 3.9-2
3.9.3 Consistency with Plans and Laws 3.9-5
3.9.4 Methods for Evaluating Impacts 3.9-7
3.9.5 Affected Environment 3.9-16
3.9.6 Environmental Consequences 3.9-52
3.9.7 Mitigation Measures 3.9-66
3.9.8 Impact Summary for NEPA Comparison of Alternatives 3.9-67
3.9.9 CEQA Significance Conclusions 3.9-75
3.10 Hazardous Materials and Waste 3.10-1
3.10.1 Introduction 3.10-1
3.10.2 Laws, Regulations, and Orders 3.10-3
3.10.3 Consistency with Plans and Laws 3.10-6
3.10.4 Methods for Evaluating Impacts 3.10-7
3.10.5 Affected Environment 3.10-10
3.10.6 Environmental Consequences 3.10-25
3.10.7 Mitigation Measures 3.10-41
3.10.8 Impact Summary for NEPA Comparison of Alternatives 3.10-41
3.10.9 CEQA Significance Conclusions 3.10-49
3.11 Safety and Security 3.11-1
3.11.1 Introduction 3.11-2
3.11.2 Laws, Regulations, and Orders 3.11-5
3.11.3 Consistency with Plans and Laws 3.11-12
3.11.4 Methods for Evaluating Impacts 3.11-13
3.11.5 Affected Environment 3.11-19
3.11.6 Environmental Consequences 3.11-43
3.11.7 Mitigation Measures 3.11-85

3.11.8 Impact Summary for NEPA Comparison of Alternatives 3.11-90
3.11.9 CEQA Significance Conclusions 3.11-99
3.12 Socioeconomics and Communities 3.12-1
3.12.1 Introduction 3.12-2
3.12.2 Laws, Regulations, and Orders 3.12-4
3.12.3 Consistency with Plans and Laws 3.12-7
3.12.4 Methods for Evaluating Impacts 3.12-9
3.12.5 Affected Environment 3.12-18
3.12.6 Environmental Consequences 3.12-39
3.12.7 Mitigation Measures 3.12-98
3.12.8 Impact Summary for NEPA Comparison of Alternatives 3.12-98
3.12.9 CEQA Significance Conclusions 3.12-107
3.13 Station Planning, Land Use, and Development 3.13-1
3.13.1 Introduction 3.13-2
3.13.2 Laws, Regulations, and Orders 3.13-3
3.13.3 Consistency with Plans and Laws 3.13-4
3.13.4 Methods for Evaluating Impacts 3.13-5
3.13.5 Affected Environment 3.13-8
3.13.6 Environmental Consequences 3.13-33
3.13.7 Mitigation Measures 3.13-57
3.13.8 Impact Summary for NEPA Comparison of Alternative 3.13-57
3.13.9 CEQA Significance Conclusions 3.13-60
3.14 Agricultural Farmland 3.14-1
3.14.1 Introduction 3.14-3
3.14.2 Laws, Regulations, and Orders 3.14-6
3.14.3 Consistency with Plans and Laws 3.14-8
3.14.4 Methods for Evaluating Impacts 3.14-10
3.14.5 Affected Environment 3.14-16
3.14.6 Environmental Consequences 3.14-38
3.14.7 Mitigation Measures 3.14-52
3.14.8 Impact Summary for NEPA Comparison of Alternatives 3.14-55
3.14.9 CEQA Significance Conclusions 3.14-62
3.15 Parks, Recreation, and Open Space 3.15-1
3.15.1 Introduction 3.15-3
3.15.2 Laws, Regulations, and Orders 3.15-4
3.15.3 Consistency with Plans and Laws 3.15-6
3.15.4 Methods for Evaluating Impacts 3.15-7
3.15.5 Affected Environment 3.15-10
3.15.6 Environmental Consequences 3.15-29
3.15.7 Mitigation Measures 3.15-125
3.15.8 Impact Summary for NEPA Comparison of Alternatives 3.15-129
3.15.9 CEQA Significance Conclusions 3.15-136
3.16 Aesthetics and Visual Quality 3.16-1
3.16.1 Introduction 3.16-1
3.16.2 Laws, Regulations, and Orders 3.16-3
3.16.3 Consistency with Plans and Laws 3.16-5
3.16.4 Methods for Evaluating Impacts 3.16-6
3.16.5 Affected Environment 3.16-14
3.16.6 Environmental Consequences 3.16-78
3.16.7 Mitigation Measures 3.16-157

3.16.8 Impact Summary for NEPA Comparison of Alternatives.....3.16-160
3.16.9 CEQA Significance Conclusions.....3.16-170
3.17 Cultural Resources.....3.17-1
3.17.1 Introduction.....3.17-3
3.17.2 Laws, Regulations, and Orders.....3.17-4
3.17.3 Regional and Local Policy Analysis.....3.17-10
3.17.4 Coordination of Section 106 Process with NEPA and CEQA Compliance.....3.17-11
3.17.5 Methods for Evaluating Impacts.....3.17-14
3.17.6 Affected Environment.....3.17-21
3.17.7 Environmental Consequences.....3.17-47
3.17.8 Mitigation Measures.....3.17-139
3.17.9 Impact Summary for NEPA Comparison of Alternatives.....3.17-152
3.17.10 CEQA Significance Conclusions.....3.17-156
3.18 Regional Growth.....3.18-1
3.18.1 Introduction.....3.18-1
3.18.2 Laws, Regulations, and Orders.....3.18-2
3.18.3 Consistency with Plans and Laws.....3.18-6
3.18.4 Methods for Evaluating Impacts.....3.18-6
3.18.5 Affected Environment.....3.18-10
3.18.6 Environmental Consequences.....3.18-18
3.18.7 Mitigation Measures.....3.18-35
3.18.8 Impacts Summary.....3.18-35
3.19 Cumulative Impacts.....3.19-1
3.19.1 Introduction.....3.19-2
3.19.2 Laws, Regulations, and Orders.....3.19-2
3.19.3 Methods for Evaluating Impacts.....3.19-4
3.19.4 Cumulative Projects and Growth Forecasts.....3.19-4
3.19.5 Organization of the Cumulative Impacts Analysis.....3.19-7
3.19.6 Cumulative Impacts Analysis.....3.19-9
3.19.7 Cumulative Impact Summary.....3.19-107

4 FINAL SECTION 4(F)/6(F) EVALUATIONS.....4-1
4.1 Introduction.....4-3
4.1.1 Laws, Regulations and Orders.....4-4
4.1.2 Resource Study Area.....4-6
4.1.3 Section 4(f) Applicability.....4-8
4.1.4 Section 4(f) Use Definition.....4-9
4.2 Coordination.....4-11
4.3 Purpose and Need.....4-14
4.4 Alternatives.....4-15
4.4.1 No Project Alternative.....4-17
4.4.2 Alternative 1.....4-18
4.4.3 Alternative 2.....4-18
4.4.4 Alternative 3.....4-19
4.4.5 Alternative 4.....4-19
4.5 Section 4(f) Applicability Analysis.....4-20
4.5.1 Parks, Recreation, and Wildlife and Waterfowl Refuges.....4-20
4.5.2 Cultural Resources.....4-41
4.6 Section 4(f) Use Assessment.....4-53
4.6.1 Parks, Recreation, and Wildlife and Waterfowl Refuges.....4-53

4.6.2 Cultural Resources 4-145
4.7 Avoidance Alternatives 4-207
4.7.1 Individual Resource Avoidance Assessments 4-208
4.8 Measures to Minimize Harm 4-216
4.9 Section 4(f) Least Harm Analysis 4-220
4.9.1 Least Harm Analysis for San Jose to Central Valley Wye Project Alternatives 4-221
4.9.2 Net Harm to Section 4(f) Property 4-229
4.9.3 Impacts on Environmental Resources Outside of Section 4(f) Uses 4-230
4.10 Section 6(f) 4-230

5 ENVIRONMENTAL JUSTICE 5-1
5.1 Introduction 5-2
5.1.1 Definition of Resources 5-3
5.2 Laws, Regulations, and Orders 5-3
5.2.1 Federal 5-3
5.2.2 State 5-5
5.2.3 Regional and Local 5-6
5.3 Methods for Evaluating Effects 5-6
5.3.1 Definition of Reference Community and Resources Study Area 5-6
5.3.2 Methods for Effects Analysis 5-9
5.4 Affected Environment 5-12
5.4.1 Overview 5-12
5.4.2 Low-Income Populations 5-17
5.4.3 Minority Populations 5-27
5.4.4 Other Sensitive Populations 5-35
5.5 Environmental Justice Engagement and Documentation 5-38
5.5.1 Affected Populations and Communities 5-38
5.5.2 Engagement Methods 5-38
5.5.3 Environmental Justice Outreach Events 5-39
5.5.4 Environmental Justice Community Improvements Outreach 5-61
5.5.5 Issues and Concerns 5-63
5.5.6 Environmental Justice Engagement September 2021 5-67
5.6 Assessment of Effects 5-71
5.6.1 Overview 5-71
5.6.2 No Project Alternative 5-72
5.6.3 Project Alternatives 5-73
5.7 Summary of Disproportionately High and Adverse Effects Prior to Consideration of Offsetting Mitigation 5-131
5.8 Offsetting Mitigation Measures 5-138
5.8.1 Development and Evaluation of Potential Community Improvements 5-138
5.8.2 Community Improvements Engagement 5-139
5.8.3 Proposed Offsetting Mitigation Measures 5-141
5.8.4 Summary of Disproportionately High and Adverse Effects by Community Areas with Proposed Offsetting Mitigation Measures 5-164
5.9 California High-Speed Rail Authority's Environmental Justice Determination 5-169

6 PROJECT COSTS AND OPERATIONS 6-1
6.1 Introduction 6-1
6.2 Capital Costs 6-1
6.2.1 High-Speed Rail Alternatives 6-2
6.2.2 Maintenance of Way Facilities and Sidings 6-4
6.3 Operation and Maintenance Costs 6-5
6.3.1 Operating Speeds 6-5
6.3.2 Development of Operation and Maintenance Costs 6-5

7 OTHER CEQA/NEPA CONSIDERATIONS 7-1
7.1 Unavoidable Adverse and Significant and Unavoidable Impacts 7-1
7.1.1 Adverse Effects that Cannot Be Avoided under NEPA 7-1
7.1.2 Significant and Unavoidable Impacts under CEQA 7-5
7.2 Project Benefits 7-7
7.2.1 Transportation Benefits 7-7
7.2.2 Environmental Benefits 7-7
7.2.3 Economic and Employment Benefits 7-7
7.3 Relationship between Short-Term Use of the Environment and the Enhancement of Long-Term Productivity 7-7
7.4 Significant Irreversible Environmental Changes or Irretrievable Commitment of Resources 7-8

8 PREFERRED ALTERNATIVE 8-1
8.1 Introduction 8-2
8.2 Summary of Key Stakeholder Input 8-5
8.2.1 Local Communities 8-5
8.2.2 Native American Tribes 8-7
8.2.3 Agricultural Interests 8-7
8.2.4 Businesses 8-7
8.2.5 Environmental Organizations 8-8
8.2.6 Environmental Justice Outreach 8-8
8.2.7 Agency Consultation 8-9
8.2.8 Feedback on the Staff-Recommended Preferred Alternative 8-11
8.3 Alternatives Considered 8-12
8.4 Preferred Alternative 8-12
8.4.1 Review of Alternative Key Differentiators by Subsection 8-17
8.4.2 Preliminary Cost Estimate by Alternative 8-22
8.4.3 Additional Considerations 8-22
8.4.4 Alternative Comparison 8-23
8.4.5 Identification of the Preferred Alternative 8-24
8.5 Environmentally Superior Alternative 8-27
8.6 Environmentally Preferable Alternative 8-28
8.7 Least Environmentally Damaging Practicable Alternative 8-28

9 PUBLIC AND AGENCY INVOLVEMENT 9-1
9.1 Environmental Justice Outreach 9-2
9.2 Public and Agency Scoping (2009–2010) 9-3
9.2.1 Notices of Preparation, Notices of Intent, and Public Information Materials 9-3
9.2.2 Scoping Meetings 9-3
9.2.3 Scoping Comments 9-4
9.3 Alternatives Analysis Process (2010–2016) 9-5

9.3.1 Public Information Meetings and Materials during the Alternatives Analysis Process 9-1
9.3.2 Technical Working Group Meetings during the Alternatives Analysis Process 9-2
9.3.3 Environmental Resource Agency Meetings during the Alternatives Analysis Process 9-3
9.3.4 Tribal Coordination Meetings 9-3
9.4 Further Outreach, Consultation, and Alternatives Refinement (2016–2021) 9-3
9.4.1 Outreach, Involvement, and Communications Guidance 9-4
9.4.2 Agreements and Memoranda of Understanding 9-5
9.4.3 Public Information Materials and Meetings 9-6
9.4.4 Community Working Group Meetings 9-6
9.4.5 Tribal Coordination Meetings 9-7
9.4.6 Technical Working Group Meetings 9-7
9.4.7 Agency Meetings and Consultation 9-8
9.4.8 Section 106 Consultation, National Historic Preservation Act 9-9
9.4.9 Section 404 Consultation, Clean Water Act 9-9
9.4.10 Section 7 Consultation, Federal Endangered Species Act 9-10
9.5 Notification and Circulation of the Draft and Revised/Supplemental Draft EIR/EISs and Release of the Final EIR/EIS 9-10

10 DISTRIBUTION LIST 10-1
10.1 Repository Locations 10-2
10.2 Federal Agencies 10-2
10.3 State Agencies 10-3
10.4 Elected Officials 10-4
10.4.1 Federal Elected Official 10-4
10.4.2 State Elected Officials 10-5
10.4.3 Regional County Boards of Supervisors 10-5
10.4.4 Mayors 10-6
10.4.5 City Council Members 10-6
10.4.6 Agricultural Commissioners 10-7
10.5 Regional/Local Agencies 10-7
10.6 Organizations and Businesses 10-9
10.6.1 Commerce 10-9
10.6.2 Historical Interest Groups 10-9
10.6.3 Labor 10-10
10.6.4 Neighborhoods 10-10
10.6.5 Public Interest/Advocacy 10-11
10.6.6 Transportation 10-11
10.6.7 Other 10-12
10.7 Native American Contacts 10-12
10.8 Schools and Districts 10-13
10.8.1 Franklin-McKinley School District, San Jose, CA 10-13
10.8.2 Gilroy Unified School District, Gilroy, CA 10-13
10.8.3 Los Banos Unified School District, Los Banos, CA 10-13
10.8.4 Morgan Hill Unified School District, Morgan Hill, CA 10-14
10.8.5 Oak Grove School District, San Jose, CA 10-14
10.8.6 San Jose Unified School District, San Jose, CA 10-14
10.8.7 Santa Clara Unified School District, Santa Clara, CA 10-14

10.8.8 Santa Clara County Office of Education District, Santa Clara, CA 10-14
10.8.9 Private Schools 10-14

11 LIST OF PREPARERS 11-1
11.1 California High-Speed Rail Authority 11-1
11.2 Federal Railroad Administration (prior to the July 23, 2019, NEPA Assignment MOU) 11-2
11.3 Rail Delivery Partners 11-3
11.4 Regional Consultant Environmental Team 11-7

12 REFERENCES 12-1
Fact Sheet 12-2
Preface 12-2
Summary 12-2
Chapter 1, Project Purpose, Need, and Objectives 12-4
Chapter 2, Alternatives 12-10
Chapter 3, Affected Environment, Environmental Consequences, and Mitigation Measures 12-14
Section 3.1, Introduction 12-14
Section 3.2, Transportation 12-15
Section 3.3, Air Quality and Greenhouse Gases 12-18
Section 3.4, Noise and Vibration 12-22
Section 3.5, Electromagnetic Fields and Electromagnetic Interference 12-23
Section 3.6, Public Utilities and Energy 12-25
Section 3.7, Biological and Aquatic Resources 12-39
Section 3.8, Hydrology and Water Resources 12-50
Section 3.9, Geology, Soils, Seismicity and Paleontological Resources 12-57
Section 3.10, Hazardous Materials and Waste 12-62
Section 3.11, Safety and Security 12-63
Section 3.12, Socioeconomics and Communities 12-72
Section 3.13, Station Planning, Land Use, and Development 12-76
Section 3.14, Agricultural Farmland 12-77
Section 3.15, Parks, Recreation, and Open Space 12-82
Section 3.16, Aesthetics and Visual Quality 12-84
Section 3.17, Cultural Resources 12-85
Section 3.18, Regional Growth 12-86
Section 3.19, Cumulative Impacts 12-90
Chapter 4, Section 4(f)/6(f) Evaluation 12-94
Chapter 5, Environmental Justice 12-96
Chapter 6, Project Costs and Operations 12-98
Chapter 7, Other CEQA/NEPA Considerations 12-99
Chapter 8, Preferred Alternative 12-99
Chapter 9, Public and Agency Involvement 12-100

13 GLOSSARY OF TERMS 13-1

14 INDEX 14-1

15 ACRONYMS AND ABBREVIATIONS 15-1

Tables

Table S-1 San Jose to Central Valley Wye Design Options by Subsection S-22
Table S-2 HSR Impact Avoidance and Minimization Features S-25
Table S-3 Comparison of Construction Impacts by Alternative S-37
Table S-4 Comparison of Operations Impacts by Alternative S-66
Table S-5 CEQA Summary of Resources with Significant Impacts and Applicable Mitigation Measures S-80
Table S-6 Significant and Unavoidable Impacts by Alternative S-110
Table S-7 Capital Cost by Alternative *(2021$ millions)* S-110
Table S-8 Comparison of Key Resource Factors by Project Alternative S-115
Table S-9 San Jose to Merced Project Section Milestone Schedule S-120
Table 1-1 Population Growth in California and the Counties of the San Jose to Merced Project Section 1-16
Table 1-2 Unemployment and Income in California and Santa Clara, San Benito, Merced, and Madera Counties 1-18
Table 1-3 Jobs/Housing Ratio 2010 and 2040 1-21
Table 1-4 Current and Projected Vehicle Miles Traveled 1-23
Table 1-5 Travel Growth for Intercity Highways 1-24
Table 1-6 Estimated Total Travel Times (Door-to-Door in Hours and Minutes) between City Pairs by Auto, Air, and Rail (Peak Conditions) 1-27
Table 2-1 San Jose to Central Valley Wye Project Extent Subsections 2-6
Table 2-2 HSR Performance Criteria 2-8
Table 2-3 San Jose to Carlucci Road: Design Options Considered 2-34
Table 2-4 Regional Projected Population and Employment Projections, 2015 and 2040 2-40
Table 2-5 Planned Transportation Improvements 2-43
Table 2-6 Planned Passenger Rail Projects (Forecast Year 2040) 2-47
Table 2-7 San Jose to Central Valley Wye Design Options by Subsection 2-53
Table 2-8 Design Features of the HSR Build Alternatives 2-59
Table 2-9 Summary of Diridon Station Features 2-65
Table 2-10 Comparison of Alternative Gilroy Station Features 2-67
Table 2-11 Existing Bridges That Could Require Retrofit 2-72
Table 2-12 Impact of HSR Alternatives on Caltrans Facilities 2-73
Table 2-13 High-Speed Rail System Ridership Forecasts (in millions per year) 2-136
Table 2-14 Total Daily Operations—San Jose to Merced Project Section 2-141
Table 2-15 Right-of-Way Acquisitions 2-144
Table 2-16 Overall Construction Schedule 2-146
Table 2-17 Construction Staging and Precasting Yards by Alternative 2-149
Table 2-18 Anticipated Environmental Reviews, Permits, and Approvals 2-166
Table 3.1-1 San Jose to Central Valley Wye Design Options by Subsection 3.1-4

Table 3.1-2 Comparison of Project Alternative Impacts for Air Quality and Greenhouse Gases (Example) 3.1-14
Table 3.1-3 CEQA Significance Conclusions and Mitigation Measures for Air Quality and Greenhouse Gases (Example) 3.1-15
Table 3.2-1 Definition of Transportation Resource Study Areas 3.2-9
Table 3.2-2 2029 and 2040 Ridership at High-Speed Rail Stations 3.2-11
Table 3.2-3 2029 and 2040 Passenger Trip Generation at High-Speed Rail Stations 3.2-12
Table 3.2-4 2029 and 2040 Passengers per Vehicle by Mode 3.2-13
Table 3.2-5 2029 and 2040 Vehicle Trip Generation at High-Speed Rail Stations 3.2-13
Table 3.2-6 2029 and 2040 Vehicle Trip Generation at Maintenance of Way Facilities 3.2-14
Table 3.2-7 Freeway Level of Service Definitions 3.2-16
Table 3.2-8 Signalized Intersection Level of Service Definitions 3.2-16
Table 3.2-9 Unsignalized Intersection Level of Service Definitions 3.2-17
Table 3.2-10 Existing Rail Ridership at San Jose Diridon and Gilroy Stations 3.2-33
Table 3.2-11 2029 and 2040 No Project Conditions Roadway Improvements 3.2-48
Table 3.2-12 2029 and 2040 No Project Freeway Segment Operations 3.2-49
Table 3.2-13 2029 and 2040 No Project Intersection Operations 3.2-50
Table 3.2-14 Permanent Roadway Closures and Changes by Subsection and Alternative 3.2-55
Table 3.2-15 Displacement of Parking Adjacent to San Jose Diridon Station 3.2-71
Table 3.2-16 2029 and 2040 No Project Transit Improvements 3.2-79
Table 3.2-17 Assumed 2029 Passenger and Freight Train Operations 3.2-80
Table 3.2-18 Assumed 2040 Passenger and Freight Train Operations 3.2-81
Table 3.2-19 Plus Project Bus Performance Delay Impacts from Vehicle Trips 3.2-88
Table 3.2-20 Changes in Caltrain System Average Weekday Ridership, 2040 Plus Project 2040 ..... 3.2-89
Table 3.2-21 No Project Conditions Bicycle and Pedestrian Improvements 3.2-92
Table 3.2-22 Existing and Assumed Future Freight Train Operations 3.2-96
Table 3.2-23 2040 Planned Rail Capacity Improvements 3.2-96
Table 3.2-24 Transportation-Specific Mitigation Measures 3.2-104
Table 3.2-25 Intersections with Adverse Effects after Mitigation 3.2-114
Table 3.2-26 Comparison of Project Alternative Impacts for Transportation 3.2-120
Table 3.2-27 CEQA Significance Conclusions and Mitigation Measures for Transportation 3.2-130
Table 3.3-1 State and Federal Ambient Air Quality Standards 3.3-5
Table 3.3-2 Definition of Air Quality and Greenhouse Gases Resource Study Areas 3.3-15
Table 3.3-3 General Conformity Rule *de minimis* Thresholds for the Project 3.3-25
Table 3.3-4 BAAQMD, MBARD, and SJVAPCD Regional Mass Emission Thresholds 3.3-28

Table 3.3-5 BAAQMD, MBARD, and SJVAPCD Cancer and Noncancer Health Risk Thresholds 3.3-30
Table 3.3-6 Ambient Criteria Pollutant Concentrations at Air Quality Monitoring Stations along the Project Corridor 3.3-35
Table 3.3-7 Federal and State Attainment Status along the Project Corridor within the SFBAAB, NCCAB, and SJVAB 3.3-39
Table 3.3-8 Sensitive Receptor Locations within 1,000 Feet of the San Jose Diridon and Gilroy Stations and East Gilroy Maintenance of Way Facility 3.3-40
Table 3.3-9 State Implementation Plans 3.3-46
Table 3.3-10 Estimated Statewide Emissions, No Project Alternative: Medium Ridership Scenario 3.3-49
Table 3.3-11 Estimated Statewide Emissions, No Project Alternative: High Ridership Scenario 3.3-50
Table 3.3-12 Construction-Related Criteria Pollutant Emissions in the San Francisco Bay Area Air Basin 3.3-53
Table 3.3-13 Construction-Related Criteria Pollutant Emissions in the North Central Coast Air Basin by Alternative 3.3-57
Table 3.3-14 Construction-Related Criteria Pollutant Emissions in the San Joaquin Valley Air Basin 3.3-61
Table 3.3-15 Maximum Hourly and Daily CAAQS Criteria Pollutant Concentration Impacts from Project Construction (µg/m^3) 3.3-65
Table 3.3-16 Maximum Hourly and Daily NAAQS Criteria Pollutant Concentration Impacts from Project Construction (µg/m^3) 3.3-67
Table 3.3-17 Maximum Annual CAAQS and NAAQS Criteria Pollutant Concentration Impacts from Project Construction (µg/m^3) 3.3-69
Table 3.3-18 Maximum Incremental PM_{10} and $PM_{2.5}$ Concentrations from Project Construction (µg/m^3) 3.3-71
Table 3.3-19 Excess Cancer, Noncancer, and $PM_{2.5}$ Concentration Health Risks Associated with Construction of Alternatives 1, 2, 3, and 4 in the Bay Area Air Quality Management District 3.3-74
Table 3.3-20 Excess Cancer and Noncancer Health Risks Associated with Construction of Alternatives 1, 2, 3, and 4 in the Monterey Bay Air Resources District 3.3-75
Table 3.3-21 Excess Cancer and Noncancer Health Risks Associated with Construction of Alternatives 1, 2, 3, and 4 in the San Joaquin Valley Air Pollution Control District 3.3-76
Table 3.3-22 Summary of Regional Criteria Pollutant Emissions Changes from Project Operations (under the Medium and High Ridership Scenarios) Relative to the 2015 Existing Conditions (tons per year) 3.3-80
Table 3.3-23 Summary of Total Regional Criteria Pollutant Emissions Changes from Project Operations (under the Medium and High Ridership Scenarios) Relative to the 2029 No Project Alternative (tons per year) 3.3-82
Table 3.3-24 Summary of Total Regional Criteria Pollutant Emissions Changes from Project Operations (under the Medium- and High-Ridership Scenarios) Relative to the 2040 No Project Alternative (tons per year) 3.3-84

Table 3.3-25 Carbon Monoxide Modeling Concentration Results (parts per million) 3.3-89
Table 3.3-26 Summary of Changes in Cancer and Noncancer Health Risks from Freight Relocation Relative to Existing and No Project Conditions 3.3-94
Table 3.3-27 Maximum Health Risks and $PM_{2.5}$ Concentrations from Project Station and MOWF Operations 3.3-96
Table 3.3-28 Comparison of Total Carbon Dioxide Equivalent Emissions from Construction of the Project Alternatives (metric tons) 3.3-98
Table 3.3-29 Summary of Statewide Greenhouse Gas Emissions Changes from Project Operations (under the Medium and High Ridership Scenarios) Relative to Existing, 2029, and 2040 No Project Conditions (metric tons CO_2e per year) 3.3-100
Table 3.3-30 Summary of Required Mitigation for Project Construction by Alternative 3.3-102
Table 3.3-31 Comparison of Project Alternative Impacts for Air Quality and Greenhouse Gases 3.3-106
Table 3.3-32 CEQA Significance Conclusions and Mitigation Measures for Air Quality and Greenhouse Gases 3.3-113
Table 3.3-33 Estimated Incidence of Health Endpoints Based on Total Directly Emitted NO_x, SO_x, and $PM_{2.5}$ Emissions during Construction of Alternative 4 ..... 3.3-119
Table 3.4-1 Definition of Noise and Vibration Resource Study Areas 3.4-12
Table 3.4-2 Federal Railroad Administration Recommended Screening Distances for Evaluation of High-Speed Rail Noise Impacts 3.4-13
Table 3.4-3 Federal Railroad Administration Recommended Screening Distances for Vibration Assessments 3.4-14
Table 3.4-4 Federal Railroad Administration Detailed Assessment Criteria for Construction Noise 3.4-16
Table 3.4-5 Federal Railroad Administration Land Use Categories for Noise Exposure 3.4-17
Table 3.4-6 Interim Criteria for High-Speed Rail Train Noise Impacts on Livestock 3.4-20
Table 3.4-7 Assumed 2029 and 2040 Project Operations for Noise Impact Assessment 3.4-21
Table 3.4-8 Federal Railroad Administration Construction Vibration Damage Criteria 3.4-24
Table 3.4-9 Ground-Borne Vibration and Ground-Borne Vibration Impact Criteria for General Assessment 3.4-25
Table 3.4-10 Ground-Borne Vibration and Ground-Borne Noise Impact Criteria for Special Use Buildings 3.4-25
Table 3.4-11 Ambient Noise Measurement Results 3.4-28
Table 3.4-12 Existing Vibration Measurement Locations 3.4-34
Table 3.4-13 Vibration Propagation Measurement Locations 3.4-36
Table 3.4-14 Differences among Alternatives 3.4-40
Table 3.4-15 Construction Activity Noise Levels 3.4-41

Table 3.4-16 Summary of 2029 No Project and 2029 Plus Project Noise Impacts 3.4-44
Table 3.4-17 Summary of 2040 No Project and 2040 Plus Project Noise Impacts 3.4-46
Table 3.4-18 2029 and 2040 Plus Project Number of Roadway Segments with Traffic-Related Noise Increases More than 3 dBA above Existing Noise Conditions 3.4-71
Table 3.4-19 Screening Distances for Impacts on Livestock 3.4-72
Table 3.4-20 Traction Power Facility Noise Analysis—Number of Affected Receptors 3.4-74
Table 3.4-21 2029 and 2040 Plus Project Potential Vibration Impacts 3.4-78
Table 3.4-22 Vibration Mitigation Procedures and Descriptions 3.4-95
Table 3.4-23 Proposed Noise Barriers—Alternative 1 ..... 3.4-98
Table 3.4-24 Proposed Noise Barriers—Alternative 2 ..... 3.4-99
Table 3.4-25 Proposed Noise Barriers—Alternative 3 ..... 3.4-100
Table 3.4-26 Proposed Noise Barriers without Quiet Zones—Alternative 4 ..... 3.4-101
Table 3.4-27 Proposed Noise Barriers with Quiet Zones—Alternative 4 ..... 3.4-120
Table 3.4-28 Noise Mitigation Effectiveness—Alternative 1 ..... 3.4-121
Table 3.4-29 Noise Mitigation Effectiveness—Alternative 2 ..... 3.4-122
Table 3.4-30 Noise Mitigation Effectiveness—Alternative 3 ..... 3.4-122
Table 3.4-31 Noise Mitigation Effectiveness—Alternative 4 ..... 3.4-124
Table 3.4-32 Sound Insulation Mitigation Effectiveness for Indoor Noise Levels 3.4-124
Table 3.4-33 Comparison of Project Alternative Impacts for Noise and Vibration 3.4-126
Table 3.4-34 CEQA Significance Conclusions and Mitigation Measures for Noise and Vibration 3.4-132
Table 3.4-35 Noise Mitigation Effectiveness 3.4-136
Table 3.5-1 Relationship between Typical Frequencies and Their Wavelengths 3.5-4
Table 3.5-2 Typical Magnetic Field Strengths 3.5-4
Table 3.5-3 Typical EMF Levels for Transmission/Power Lines 3.5-5
Table 3.5-4 IEEE C95.6 Magnetic Field Maximum Permissible Exposure Levels for the General Public 3.5-7
Table 3.5-5 IEEE C95.6 Electric Field Maximum Permissible Exposure Levels for the General Public 3.5-7
Table 3.5-6 Radio Frequency Emissions Safety Levels Expressed as Maximum Permissible Exposure 3.5-9
Table 3.5-7 Maximum Permissible Exposure Levels to Determine CEQA Significance 3.5-15
Table 3.5-8 EMI Measurement Locations 3.5-16
Table 3.5-9 Measured and Modeled 60 Hz Magnetic Field Strengths 3.5-23
Table 3.5-10 Estimated EMF Field Strength for Caltrain Operations (frequency of 60 Hz) 3.5-24

Table 3.5-11 Sensitive Receptors and Facilities Potentially Affected by HSR System Construction and Operations 3.5-25
Table 3.5-12 Sensitive Receptors and Facilities Potentially Affected by Electrical Infrastructure and Network Upgrades 3.5-30
Table 3.5-13 Summary of HSR Exterior EMF Levels 3.5-34
Table 3.5-14 Comparison of Project Alternative Impacts for EMFs and EMI 3.5-43
Table 3.5-15 CEQA Significance Conclusions and Mitigation Measures for the EMFs and EMI 3.5-47
Table 3.6-1 Definition of Public Utilities and Energy Resource Study Areas 3.6-12
Table 3.6-2 Summary of Utility and Energy Providers within the Resource Study Areas 3.6-18
Table 3.6-3 Major Utility Lines within the Public Utility Resource Study Area 3.6-21
Table 3.6-4 Existing and Projected Urban Potable Water Demand in the Resource Study Area 3.6-35
Table 3.6-5 Wastewater Treatment Plant Capacity within the Resource Study Area 3.6-37
Table 3.6-6 Solid Waste Landfill Facility Permitted and Remaining Capacities 3.6-42
Table 3.6-7 Solid Waste Disposal Volumes and Diversion Summary 3.6-43
Table 3.6-8 Electricity Consumption in Santa Clara, San Benito, and Merced Counties, 2015 ..... 3.6-45
Table 3.6-9 Fuel Sources for Electric Power in California in 2015 ..... 3.6-46
Table 3.6-10 Natural Gas Consumption in Santa Clara, San Benito, and Merced Counties in 2015 ..... 3.6-50
Table 3.6-11 Construction Water Use by Alternative and Activity 3.6-55
Table 3.6-12 Annual Construction Water Use Summary by Alternative 3.6-57
Table 3.6-13 Major Utility Conflicts and New Utility Installations 3.6-59
Table 3.6-14 Solid Waste Generation Estimates by Alternative in Cubic Yards 3.6-73
Table 3.6-15 Hazardous Waste Generation Estimates by Alternative in Cubic Yards 3.6-73
Table 3.6-16 Estimated Nonrecoverable Construction-Related Energy Consumption for the Project Alternatives 3.6-82
Table 3.6-17 HSR Operational Electricity Consumption (Medium and High Ridership Scenarios) 3.6-86
Table 3.6-18 Estimated Changes in Vehicle Miles Traveled and Energy Consumption (Medium and High Ridership Scenarios) 3.6-87
Table 3.6-19 Estimated Changes in Airplane Flights and Energy Consumption (Medium and High Ridership Scenarios) 3.6-88
Table 3.6-20 Summary of Regional Changes in Energy Consumption (Medium and High Ridership Scenarios) 3.6-90
Table 3.6-21 Summary of Statewide Changes in Energy Consumption (Medium and High Ridership Scenarios) 3.6-91
Table 3.6-22 Comparison of Project Alternative Impacts for Public Utilities and Energy 3.6-95

Table 3.6-23 CEQA Significance Conclusions and Mitigation Measures for Public Utilities and Energy 3.6-101
Table 3.7-1 Definition of Biological and Aquatic Resource Study Areas 3.7-18
Table 3.7-2 Field Surveys and Personnel 3.7-27
Table 3.7-3 Soil Associations of the San Jose to Central Valley Wye Project Extent 3.7-38
Table 3.7-4 Crosswalk of Land Cover Classification to Other Classification Systems 3.7-39
Table 3.7-5 Land Cover Types within the Project Footprint and Habitat Study Areas (acres) 3.7-42
Table 3.7-6 Critical Habitat Designations by Subsection 3.7-46
Table 3.7-7 Roosting Patterns for Bat Species Potentially Occurring in the Habitat Study Area 3.7-50
Table 3.7-8 Special-Status Plant Communities Potentially Occurring in the Special-Status Plant Study Area 3.7-51
Table 3.7-9 Aquatic Resources by Subsection 3.7-52
Table 3.7-10 Potential Presence of Protected Trees by Subsection 3.7-54
Table 3.7-11 Conservation Areas by Subsection 3.7-58
Table 3.7-12 Impacts on Habitat for Special-Status Plant Species by Project Alternative (acres) 3.7-64
Table 3.7-13 Direct Impacts on Special-Status Wildlife Species Habitat by Project Alternative (acres) 3.7-67
Table 3.7-14 Impacts on Critical Habitat by Project Alternative 3.7-76
Table 3.7-15 Surface Waters Overlying Tunnels 1 and 2 ..... 3.7-81
Table 3.7-16 Impacts on Habitat for Waterfowl and Shorebirds in Important Bird Areas by Project Alternative (acres) 3.7-117
Table 3.7-17 Impacts on Special-Status Plant Communities (acres) 3.7-119
Table 3.7-18 Impacts on Aquatic Resources Considered Waters of the U.S. or Waters of the State by Alternative (acres) 3.7-122
Table 3.7-19 Impacts on Aquatic and Other Related Resources Regulated under California Fish and Game Code Section 1600 et seq. by Alternative (acres) 3.7-124
Table 3.7-20 Impacts on Land Cover Types Likely to Support Protected Trees by Alternative (acres) 3.7-126
Table 3.7-21 Extent of Noise Impacts by Mechanism 3.7-134
Table 3.7-22 Direct Impacts on Conservation Areas by Project Alternative (acres) 3.7-143
Table 3.7-23 Summary of Potential Conflicts with Wildlife Crossing Modifications Described in the Coyote Valley Linkage 3.7-149
Table 3.7-24 Mitigation Measures for Impacts on Biological and Aquatic Resources by Alternative 3.7-152
Table 3.7-25 Potential Nonbiological Impacts of Compensatory Mitigation Implementation 3.7-166
Table 3.7-26 Comparison of Project Alternative Impacts for Biological and Aquatic Resources (acres) 3.7-207

Table 3.7-27 CEQA Significance Conclusions and Mitigation Measures for Biological and Aquatic Resources 3.7-234
Table 3.7-28 Summary of Effects for Federally Listed Species and their Critical Habitat 3.7-279
Table 3.8-1 MS4 Permit Requirements 3.8-6
Table 3.8-2 Definition of Hydrology and Water Resources Resource Study Areas 3.8-13
Table 3.8-3 Summary of Data Sources 3.8-17
Table 3.8-4 Climate Summary 3.8-20
Table 3.8-5 Hydrologic Regions, Units, and Areas 3.8-22
Table 3.8-6 Aquatic Resources by Subsection 3.8-25
Table 3.8-7 Water Quality Objectives 3.8-28
Table 3.8-8 Groundwater Basins and Subbasins (acres) 3.8-31
Table 3.8-9 Potential Tunnel Groundwater Conditions by Geologic Unit 3.8-34
Table 3.8-10 Approximate Groundwater Depth below Ground Surface 3.8-35
Table 3.8-11 Beneficial Uses of Groundwater Subbasins in the RSA 3.8-35
Table 3.8-12 Depths of Drinking Water Supply Wells by Groundwater Subbasin 3.8-36
Table 3.8-13 FEMA Flood Hazard Zones 3.8-37
Table 3.8-14 Hydraulic Conditions of Existing Bridges and Overbank Areas in the Project Footprint 3.8-38
Table 3.8-15 Waterbodies Anticipated to Experience Minor Disturbances 3.8-46
Table 3.8-16 Waterbodies in Which Construction is Anticipated to Occur 3.8-47
Table 3.8-17 Earthwork Quantities 3.8-49
Table 3.8-18 Waterbodies with New Crossings and Waterbodies Modified, Realigned, or Otherwise Affected 3.8-50
Table 3.8-19 Estimates of New and Replaced Impervious Surfaces 3.8-55
Table 3.8-20 Waterbodies with Intermittent Bridge, Culvert, and/or Vegetation Maintenance 3.8-58
Table 3.8-21 Estimated Disturbed Soil Area 3.8-61
Table 3.8-22 Waterbodies with Impacts from the Release of Contaminants from Operating Trains 3.8-72
Table 3.8-23 Estimates of Impervious Surfaces Constructed in Groundwater Subbasins 3.8-78
Table 3.8-24 Public Drinking Water Supply Wells in the Project Footprint (Well Identification Numbers) 3.8-80
Table 3.8-25 Groundwater Conditions Observed during Construction of Central Valley Project Tunnels by Geologic Unit 3.8-85
Table 3.8-26 Anticipated Groundwater Conditions along Tunnel 1 and Tunnel 2 ..... 3.8-88
Table 3.8-27 Tunnel Excavation Methods and Likelihood for Groundwater Effects 3.8-90
Table 3.8-28 Potential Temporary Groundwater and Hydrology Effects of Tunneling 3.8-94

Table 3.8-29 Proposed Hydraulic Structures in 100-Year Floodplains 3.8-106
Table 3.8-30 Specific Design Elements that would Minimize Permanent Floodplain Impacts 3.8-110
Table 3.8-31 Existing and Proposed Peak 100-Year Flows of the Soap Lake Floodplain in the ICM Hydraulic Model 3.8-118
Table 3.8-32 Floodplains Requiring Authorizations under the Rivers and Harbors Act or Watershed Protection and Flood Prevention Act 3.8-119
Table 3.8-33 Hydrology and Water Resources-Specific Mitigation Measures 3.8-121
Table 3.8-34 Comparison of Project Alternative Impacts for Hydrology and Water Resources 3.8-132
Table 3.8-35 CEQA Significance Conclusions and Mitigation Measures for Hydrology and Water Resources 3.8-142
Table 3.9-1 Definition of Geology, Soils, and Seismicity Resource Study Areas 3.9-8
Table 3.9-2 Definition of Paleontological Resources Study Area 3.9-11
Table 3.9-3 Evaluation of Paleontological Sensitivity/Paleontological Potential 3.9-12
Table 3.9-4 Comparison of Geologic Unit Terminology Used for the Geology, Soils, and Seismicity Analysis and Paleontological Resources Analysis 3.9-14
Table 3.9-5 Distribution of Geologic Units throughout the Geology, Soils, and Seismicity RSA 3.9-24
Table 3.9-6 Soil Association Characteristics throughout the Geology, Soils and Seismicity RSA 3.9-27
Table 3.9-7 Paleontological Potential of Geologic Units within the Paleontological Resources RSA 3.9-48
Table 3.9-8 Previously Recorded UCMP Fossil Vertebrate Localities in the Vicinity (1 mile) of the Paleontological Resources RSA 3.9-50
Table 3.9-9 Distribution of Geologic Units by Subsection within the Paleontological Resources RSA 3.9-51
Table 3.9-10 Comparison of Project Alternative Impacts for Geology, Soils, Seismicity, and Paleontological Resources 3.9-68
Table 3.9-11 CEQA Significance Conclusions and Mitigation Measures for Geology, Soils, Seismicity, and Paleontological Resources 3.9-76
Table 3.10-1 Definition of Hazardous Materials and Waste Resource Study Areas 3.10-8
Table 3.10-2 Summary by Subsection of Medium- and High-Risk PEC Sites within the PEC RSA 3.10-18
Table 3.10-3 Risk of Railway Impacts by Subsection 3.10-18
Table 3.10-4 Risk of Lead-Based Paint by Subsection 3.10-19
Table 3.10-5 Risk of Asbestos-Containing Materials by Subsection 3.10-20
Table 3.10-6 Risk of Pesticides by Subsection 3.10-20
Table 3.10-7 Risk of PCBs by Subsection 3.10-21
Table 3.10-8 Risk of Aerially Deposited Lead by Subsection 3.10-21
Table 3.10-9 Risk of Naturally Occurring Asbestos by Subsection 3.10-22
Table 3.10-10 Risk of Landfills by Subsection 3.10-23

Table 3.10-11 Risk of Oil and Gas Wells by Subsection 3.10-23
Table 3.10-12 Summary of Airport Occurrence by Subsection 3.10-23
Table 3.10-13 Educational Facilities within the Schools RSA 3.10-24
Table 3.10-14 Summary by Alternative of Medium- and High-Risk PEC Sites within the PEC RSA 3.10-30
Table 3.10-15 Summary by Alternative of Educational Facilities within the Schools RSA 3.10-40
Table 3.10-16 Comparison of Project Alternative Impacts for Hazardous Materials and Waste 3.10-42
Table 3.10-17 CEQA Significance Conclusions and Mitigation Measures for Hazardous Materials and Waste 3.10-49
Table 3.11-1 Definition of Safety and Security Resource Study Areas 3.11-14
Table 3.11-2 Service Areas and Response Times for Police and Sheriff Departments in the Resource Study Area 3.11-26
Table 3.11-3 Service Areas and Response Times for Municipal and County Fire Departments in the Resource Study Area 3.11-28
Table 3.11-4 Required Response Times for Contracted Ambulance Services in Santa Clara County 3.11-30
Table 3.11-5 Pedestrian and Bicyclist Victims Killed or Injured within Resource Study Area Jurisdictions, 2017 ..... 3.11-34
Table 3.11-6 Adopted Bicycle Master Plans within Resource Study Area Jurisdictions 3.11-35
Table 3.11-7 Airports and Heliports within the Airports Resource Study Area 3.11-35
Table 3.11-8 Schools within the Resource Study Area by Subsection 3.11-37
Table 3.11-9 High-Risk Facilities within 2 miles of the Project Footprint 3.11-40
Table 3.11-10 Tall Structures within the Resource Study Area 3.11-41
Table 3.11-11 Existing and Existing Plus Project Travel Times on Monterey Road from Bernal Road to Capitol Expressway Caused by Roadway Changes 3.11-53
Table 3.11-12 Existing, 2029 No Project, 2029 Plus Project, 2040 No Project and 2040 Plus Project Travel Times on Monterey Road from Bernal Road to Capitol Expressway 3.11-55
Table 3.11-13 Airport Influence Area Encroachment Area for Each Project Alternative 3.11-66
Table 3.11-14 Blended System and Dedicated System Track for Each Alternative (miles) 3.11-71
Table 3.11-15 State-Designated Fire Severity Zone Areas by Alternative (acres) 3.11-84
Table 3.11-16 Safety and Security-Specific Mitigation Measures 3.11-85
Table 3.11-17 Comparison of Project Alternative Impacts for Safety and Security 3.11-91
Table 3.11-18 CEQA Significance Conclusions and Mitigation Measures for Safety and Security 3.11-100
Table 3.12-1 Definition of Socioeconomic and Community Resource Study Areas 3.12-10

Table 3.12-2 Cities and Communities by Subsection 3.12-19
Table 3.12-3 Community and Public Facilities within 0.5 mile of the Project Alternatives 3.12-21
Table 3.12-4 School Year 2015–2016 Funding for School Districts in the RSA 3.12-34
Table 3.12-5 Agricultural Production in Santa Clara, San Benito, and Merced Counties in 2015 ..... 3.12-35
Table 3.12-6 General Property Tax Levies by County for Fiscal Year 2014/2015 ..... 3.12-36
Table 3.12-7 Community and Public Facilities within 250 Feet of Project Construction 3.12-41
Table 3.12-8 Residential, Business, and Community Facility Displacements and Permanent Road Closures by Subsection and Alternative 3.12-49
Table 3.12-9 Schools/Daycare Facilities within 1,000 feet of Project Construction 3.12-60
Table 3.12-10 Estimated Property Displacements 3.12-65
Table 3.12-11 Estimated Number of Displaced Residential Units by Housing Type and Alternative 3.12-66
Table 3.12-12 Estimated Number of Displaced Residences and Population to be Relocated by Alternative 3.12-67
Table 3.12-13 Estimated Number of Displaced Commercial and Industrial Businesses 3.12-72
Table 3.12-14 Community and Public Facility Displacements by Alternative 3.12-76
Table 3.12-15 Estimated Annual School District Funding Losses from Acquisitions 3.12-81
Table 3.12-16 Projected Economic Impacts of Changes in Agricultural Production 3.12-85
Table 3.12-17 Dairy Farms Affected by Construction of the Project 3.12-86
Table 3.12-18 Projected Economic Impacts of Changes in Dairy Production (Merced County) 3.12-87
Table 3.12-19 Annual Lost Property Tax Revenue (FY 2015/2016) 3.12-88
Table 3.12-20 Construction Spending within Region, by Alternative and Economic Sector (2015$ in millions) 3.12-90
Table 3.12-21 Taxable Sales within Region, by Alternative and Economic Sector (2015$ in millions) 3.12-91
Table 3.12-22 Projected Sales Tax Revenues Generated During Construction (2015$ in millions) 3.12-91
Table 3.12-23 Comparison of Project Alternative Impacts for Socioeconomics and Communities 3.12-100
Table 3.12-24 CEQA Significance Conclusions and Mitigation Measures for Socioeconomics and Communities 3.12-108
Table 3.13-1 Definition of Station Planning, Land Use, and Development Resource Study Area 3.13-6
Table 3.13-2 Distribution of Existing Land Uses and Current Zoning Opportunities within the HSR Station Areas 3.13-25

Table 3.13-3 Summary of Planned Development Projects within Station and Maintenance Facility RSAs 3.13-31
Table 3.13-4 Temporary Use of Land outside the Permanent HSR Right-of-Way for the Project Alternatives 3.13-36
Table 3.13-5 Land Use Permanently Converted by the Project Alternatives 3.13-45
Table 3.13-6 Summary of Permanent Land Conversion by Project Alternative 3.13-49
Table 3.13-7 Population Projections 2015–2040 ..... 3.13-55
Table 3.13-8 Comparison of Project Alternative Impacts for Station Planning, Land Use, and Development 3.13-58
Table 3.13-9 CEQA Significance Conclusions and Mitigation Measures for Station Planning, Land Use, and Development 3.13-61
Table 3.14-1 Criteria Evaluated in Form NRCS-CPA-106 for LESA 3.14-12
Table 3.14-2 Total Acreage and Agricultural Land Acreage in Santa Clara, San Benito, and Merced Counties (2014) 3.14-16
Table 3.14-3 Important Farmland in Santa Clara, San Benito, and Merced Counties in 2002 and 2014 (acres) 3.14-19
Table 3.14-4 Change in Farmland Protected by Williamson Act Contracts in Santa Clara, San Benito, and Merced Counties in 2002 and 2014 (acres) 3.14-25
Table 3.14-5 Important Farmland within Agricultural Conservation Easements That Intersect the RSA (acres) 3.14-30
Table 3.14-6 Important Farmland Temporarily Used for Project Construction (acres) 3.14-40
Table 3.14-7 Important Farmland Permanently Converted to Nonagricultural Use in the Project Footprint (acres) 3.14-42
Table 3.14-8 Natural Resources Conservation Service Land Evaluation and Site Assessment: Farmland Conversion Impact Rating Scores 3.14-43
Table 3.14-9 Number of Nonviable Remnant Parcels and Acreage of Important Farmland in Nonviable Remnant Parcels Converted to Nonagricultural Use 3.14-44
Table 3.14-10 Major Utility Crossings 3.14-45
Table 3.14-11 Permanent Road Closures on Agricultural Farmland 3.14-48
Table 3.14-12 Modifications to Farm Roads 3.14-48
Table 3.14-13 Important Farmland within Agricultural Conservation Easements Permanently Converted by the Project Alternatives (acres) 3.14-52
Table 3.14-14 Comparison of Project Alternative Impacts for Agricultural Farmland 3.14-56
Table 3.14-15 CEQA Significance Conclusions and Mitigation Measures for Agricultural Farmland 3.14-63
Table 3.14-16 Important Farmland Mitigation Calculations 3.14-66
Table 3.15-1 Definition of Parks, Recreation, Open Space, and School District Play Areas Resource Study Areas 3.15-7
Table 3.15-2 Parks, Recreational Facilities, and Open Space Resources by Subsection 3.15-19
Table 3.15-3 School District Play Areas by Subsection 3.15-27

Table 3.15-4 Noise, Vibration, and Construction Emissions Impacts on Use and User Experience of Parks, Recreational Facilities, and Open Space Resources 3.15-34
Table 3.15-5 Construction-Related Impacts on Access to and Use of Parks 3.15-53
Table 3.15-6 Permanent Visual Impacts on Access or Use of Parks, Recreational Facilities, and Open Space Resources 3.15-65
Table 3.15-7 Permanent Parks, Recreation, and Open Space Acquisitions 3.15-70
Table 3.15-8 Noise, Vibration, and Construction Emissions Impacts on School District Play Areas 3.15-108
Table 3.15-9 Construction-Related Reduction of Access to School District Play Areas 3.15-114
Table 3.15-10 Permanent Visual Impacts on Perceived Barriers to Use of School District Play Areas 3.15-118
Table 3.15-11 Permanent School District Play Area Acquisitions 3.15-119
Table 3.15-12 Mitigation Measures 3.15-125
Table 3.15-13 Comparison of Project Alternative Impacts for Parks, Recreation, and Open Space 3.15-130
Table 3.15-14 CEQA Significance Conclusions and Mitigation Measures for Parks, Recreation, and Open Space 3.15-136
Table 3.16-1 Affected Viewer Groups and Associated Sensitivities 3.16-11
Table 3.16-2 Santa Clara Landscape Unit Visual Character, Viewer Group Sensitivity, and Visual Quality 3.16-16
Table 3.16-3 Key Viewpoints Representing the Santa Clara Landscape Unit 3.16-19
Table 3.16-4 Diridon Station Landscape Unit Visual Character, Viewer Groups, and Visual Quality 3.16-22
Table 3.16-5 Key Viewpoints Representing the Diridon Station Landscape Unit 3.16-24
Table 3.16-6 San Jose Station Approach Landscape Unit Visual Character, Viewer Groups, and Visual Quality 3.16-27
Table 3.16-7 Key Viewpoints Representing the San Jose Station Approach Landscape Unit 3.16-29
Table 3.16-8 Communications Hill Landscape Unit Visual Character, Viewer Groups, and Visual Quality 3.16-33
Table 3.16-9 Key Viewpoint Representing the Communications Hill Landscape Unit 3.16-34
Table 3.16-10 Monterey Highway San Jose Landscape Unit Visual Character, Viewer Groups, and Visual Quality 3.16-35
Table 3.16-11 Key Viewpoints Representing the Monterey Highway San Jose Landscape Unit 3.16-39
Table 3.16-12 Coyote Valley Landscape Unit Visual Character, Viewer Groups, and Visual Quality 3.16-42
Table 3.16-13 Key Viewpoint Representing the Coyote Valley Landscape Unit 3.16-44
Table 3.16-14 US 101 Landscape Unit Visual Character, Viewer Groups, and Visual Quality 3.16-47
Table 3.16-15 Key Viewpoints Representing the US 101 Landscape Unit 3.16-48

Table 3.16-16 Morgan Hill–San Martin Landscape Unit Visual Character, Viewer Groups, and Visual Quality 3.16-51
Table 3.16-17 Key Viewpoints Representing the Morgan Hill–San Martin Landscape Unit 3.16-53
Table 3.16-18 Downtown Gilroy Landscape Unit Visual Character, Viewer Groups, and Visual Quality 3.16-56
Table 3.16-19 Key Viewpoints Representing the Downtown Gilroy Landscape Unit 3.16-58
Table 3.16-20 Pajaro–San Felipe Landscape Unit Visual Character, Viewer Groups, and Visual Quality 3.16-61
Table 3.16-21 Key Viewpoints Representing the Pajaro–San Felipe Landscape Unit 3.16-62
Table 3.16-22 Pacheco Pass Landscape Unit Visual Character, Viewer Groups, and Visual Quality 3.16-65
Table 3.16-23 Key Viewpoints Representing the Pacheco Pass Landscape Unit 3.16-66
Table 3.16-24 San Luis Landscape Unit Visual Character, Viewer Groups, and Visual Quality 3.16-69
Table 3.16-25 Romero Landscape Unit Visual Character, Viewer Groups, and Visual Quality 3.16-72
Table 3.16-26 Key Viewpoints Representing the Romero Landscape Unit 3.16-73
Table 3.16-27 Henry Miller Landscape Unit Visual Character, Viewer Groups, and Visual Quality 3.16-76
Table 3.16-28 Key Viewpoints Representing the Henry Miller Landscape Unit 3.16-77
Table 3.16-29 Summary of Visual Quality Change and Degree of Impact for Project Alternatives 3.16-78
Table 3.16-30 Landscape Unit-Specific Temporary Construction Activities 3.16-83
Table 3.16-31 Comparison of Project Alternative Impacts for Aesthetics and Visual Quality 3.16-162
Table 3.16-32 CEQA Significance Conclusions and Mitigation Measures for Aesthetics and Visual Quality 3.16-170
Table 3.17-1 Section 106 Technical Reports and Concurrence Dates 3.17-12
Table 3.17-2 Demolished Built Resources in the Area of Potential Effects with No Archaeological Significance 3.17-18
Table 3.17-3 Previously Identified Archaeological Resources in the Area of Potential Effects 3.17-25
Table 3.17-4 Significant Built Resources 3.17-30
Table 3.17-5 Archaeological Sensitivity by Alternative 3.17-49
Table 3.17-6 Summary of Mitigation Measures Applicable to Each Alternative 3.17-142
Table 3.17-7 Comparison of Project Alternative Impacts for Cultural Resources 3.17-153
Table 3.17-8 CEQA Significance Conclusions and Mitigation Measures for Cultural Resources 3.17-156

Table 3.17-9 CEQA Significance Conclusions for Impact CUL#4: Permanent Demolition, Destruction, Relocation, or Alteration of Built Resources or Setting 3.17-161
Table 3.18-1 RSA and County Characteristics, 2015 ..... 3.18-10
Table 3.18-2 Regional Employment by Industry (2000, 2015, 2020, and 2024) 3.18-13
Table 3.18-3 Regional Long-Range Employment Projections (2015, 2020, 2024, and 2040) 3.18-14
Table 3.18-4 Labor Force Characteristics by County and City/Community in the RSA (2000, 2010, and 2015) 3.18-15
Table 3.18-5 Population Growth (2000 and 2015) 3.18-16
Table 3.18-6 Population Projections (2015 and 2040) 3.18-17
Table 3.18-7 Housing Units and Vacancy Rates (2015 and 2040) 3.18-18
Table 3.18-8 Acres of Important Farmland Affected by Project Alternatives 3.18-21
Table 3.18-9 Project Costs by Alternative (2018$ in millions) 3.18-23
Table 3.18-10 Alternative 1 Construction Employment Impacts 3.18-23
Table 3.18-11 Alternative 2 Construction Employment Impacts 3.18-24
Table 3.18-12 Alternative 3 Construction Employment Impacts 3.18-24
Table 3.18-13 Alternative 4 Construction Employment Impacts 3.18-24
Table 3.18-14 Project Total One-Time Economic Impact of Construction in the RSA 3.18-25
Table 3.18-15 Project Annual Employment Impacts during Operations and Maintenance 3.18-29
Table 3.18-16 Project Operations-Related Employed Residents and Population Growth 3.18-29
Table 3.18-17 Project Operations-Related Employment and Population Growth, Including Increased Accessibility Impacts 3.18-31
Table 3.18-18 Summary of Regional Growth Impacts by Alternative 3.18-35
Table 3.19-1 Cumulative Cancer and Noncancer Health Risks from Construction in the Bay Area Air Quality Management District 3.19-20
Table 3.19-2 Cumulative Cancer and Noncancer Health Risks from Freight Relocation 3.19-21
Table 3.19-3 Cumulative Cancer and Noncancer Health Risks from Station and MOWF Operation 3.19-24
Table 3.19-4 Cumulative Cancer and Noncancer Health Risks from Combined Construction and Operations in the Bay Area Air Quality Management District 3.19-25
Table 3.19-5 Summary of Highest Annual and Daily Emissions from Construction of Any of the Project Alternatives 3.19-28
Table 3.19-6 Summary of 2029 No Project and Plus Project Cumulative Noise Impacts on Sensitive Receptors 3.19-36
Table 3.19-7 Summary of 2040 No Project and Plus Project Cumulative Noise Impacts on Sensitive Receptors 3.19-38
Table 3.19-8 Summary of Cumulative Impacts 3.19-107
Table 4-1 Section 4(f) and 6(f) Evaluation Consultation Summary 4-12

Table 4-2 San Jose to Central Valley Wye Design Options by Subsection 4-17
Table 4-3 Parks, Recreation Areas, Open-Space, and Wildlife and Waterfowl Refuge Resources Evaluated for Potential Section 4(f) Use 4-22
Table 4-4 Historic Properties in APE Listed, Previously Determined, or Potentially Eligible for Listing in the NRHP 4-42
Table 4-5 Potential Impacts on Parks, Recreation Areas, and Wildlife and Waterfowl Refuge Resources Evaluated for Potential Section 4(f) Use 4-54
Table 4-6 Summary of Section 4(f) Uses of Parks, Recreation, and Wildlife and Waterfowl Refuges 4-144
Table 4-7 Potential Impacts on Historical Resources Evaluated for Potential Section 4(f) Use 4-147
Table 4-8 Summary of Section 4(f) Uses of NRHP-Listed or Eligible Properties 4-206
Table 4-9 Summary of Section 4(f) Avoidance Alternatives 4-216
Table 4-10 Measures to Minimize Harm 4-217
Table 4-11 Least Harm Analysis for the San Jose to Central Valley Wye Project Alternatives 4-223
Table 4-12 Section 6(f) Resources and Findings 4-231
Table 5-1 Overview of Reference Community and Resource Study Area Demographic Characteristics (2014 Estimates) 5-13
Table 5-2 Reference Community Demographic Characteristics (2014 Estimates) 5-14
Table 5-3 Cities/Communities within the Resource Study Area 5-15
Table 5-4 Resource Study Area Demographic Characteristics (2014 Estimates) 5-15
Table 5-5 Station and Maintenance Facility Resource Study Area Demographic Characteristics (2014 Estimates) 5-17
Table 5-6 Low-Income Populations within the Reference Community (2014 Estimates) 5-18
Table 5-7 Household Incomes and Low-Income Populations within the Resource Study Area (2014 Estimates) 5-18
Table 5-8 Percentage of Households Participating in the Supplemental Nutrition Assistance Program within the Resource Study Area (2014 Estimates) 5-19
Table 5-9 Minority Group Representation in the Reference Community (2014 Estimates) 5-27
Table 5-10 Minority Group Representation within the Resource Study Area (2014 Estimates) 5-28
Table 5-11 Other Sensitive Populations within the Resource Study Area (2014 Estimates) 5-36
Table 5-12 Outreach to Minority Populations and Low-Income Populations 5-39
Table 5-13 Interviews with Stakeholder Organizations Held in 2016 5-56
Table 5-14 Interviews with Stakeholder Organizations Held in 2018 and 2019 5-57
Table 5-15 Interviews with Stakeholder Organizations Conducted between November 2019 and April 2020 5-59

Table 5-16 Stakeholder/Service Provider Community Improvements Meetings Conducted between April 2020 and October 2020 5-63
Table 5-17 Stakeholder/Service Provider Community Improvements Meetings Conducted in September 2021 5-68
Table 5-18 Permanent Effects on Visual Quality within the Resource Study Area 5-82
Table 5-19 Displacements by Type 5-88
Table 5-20 Residential and Business Displacements by Subsection and City/Community 5-89
Table 5-21 Temporary Localized Criteria Pollutants Violations by Subsection 5-97
Table 5-22 Adverse Effects on Parks, Recreation, and School District Play Areas 5-102
Table 5-23 Adversely Affected Intersection Operations in Minority Communities and Low-Income Communities After Direct Mitigation 5-108
Table 5-24 Operational Noise Impacts After Direct Mitigation with Noise Barriers by Alternative 5-121
Table 5-25 Operational Noise Impacts After Direct Mitigation with Quiet Zones and Noise Barriers by Alternative 5-123
Table 5-26 Determination of Disproportionately High and Adverse Effects on Minority Populations and Low-Income Populations with Direct Mitigation Only and With Direct Mitigation and Project Benefits 5-136
Table 5-27 Summary of Proposed Offsetting Mitigation Measures 5-142
Table 5-28 Evaluation of Potential Secondary Environmental Effects of Potential Community Improvements 5-151
Table 6-1 Capital Cost of the High-Speed Rail Alternatives (2021$ millions) 6-3
Table 6-2 Medium Scenario Revenue and Annual O&M Costs 6-7
Table 8-1 Community and Environmental Factors by Alternative 8-13
Table 8-2 Capital Costs of the San Jose to Central Valley Wye Project Extent Alternatives *(2021$ millions)* 8-22
Table 8-3 Systems Sites Included in the Preferred Alternative 8-25
Table 9-1 Public and Agency Meetings Summary, December 2008–August 2009 9-4
Table 9-2 Public and Agency Meetings Summary, September 2009–September 2013 9-6
Table 9-3 Public and Agency Meetings Summary, October 2013–February 2016 Meeting 9-10
Table 9-4 Public and Agency Meetings Summary, March 2016–September 2021 9-12

Figures

Figure S-1 California High-Speed Rail Statewide System S-4
Figure S-2 San Jose to Merced Project Section S-5
Figure S-3 Overview Map of Design Options by Subsection S-21
Figure 1-1 Statewide High-Speed Rail System—Implementation Phases 1-3
Figure 1-2 Statewide High-Speed Rail System, Phase 1 and Phase 2—Project Sections 1-8
Figure 1-3 San Jose to Merced Project Section 1-10
Figure 1-4 Population Growth for Santa Clara, San Benito, Merced, and Madera Counties 1-17
Figure 1-5 Long Distance Intercity Trips in California (in millions) 1-19
Figure 1-6 Major Intercity Travel Routes and Airports 1-20
Figure 1-7 Major Roadways 1-22
Figure 2-1 HSR Alternatives with Vertical Profile 2-4
Figure 2-2 San Jose to Merced Project Section Geographic Context 2-6
Figure 2-3 Examples of Japanese Shinkansen High-Speed Trains 2-10
Figure 2-4 Example of an At-Grade Profile Showing Overhead Contact System and Vertical Arms of the Pantograph Power Pickups 2-10
Figure 2-5 Examples of Existing Stations 2-11
Figure 2-6 Two-Train Station Platform Cross Section 2-13
Figure 2-7 Four-Train Station Platform Cross Section 2-13
Figure 2-8 Typical At-Grade Cross Section 2-14
Figure 2-9 Typical At-Grade Cross Section for Blended System 2-15
Figure 2-10 Typical Retained-Fill Cross Section 2-15
Figure 2-11 Typical Retained-Cut Cross Section 2-16
Figure 2-12 Typical Covered Trench Cross Section 2-17
Figure 2-13 Typical Tunnel Cross Section 2-18
Figure 2-14 Tunnel Portal 2-18
Figure 2-15 Two-Track Viaduct 2-19
Figure 2-16 Four-Track Viaduct 2-20
Figure 2-17 Typical Straddle Bent Cross Section 2-21
Figure 2-18 Elevated HSR Road Crossing 2-22
Figure 2-19 Road Overcrossing 2-23
Figure 2-20 Typical Cross Section of Roadway Grade-Separated beneath HSR Guideway 2-23
Figure 2-21 Typical Cross Section of Wildlife Crossing Structure 2-24
Figure 2-22 Typical Plan View of Wildlife Crossing Structure 2-24
Figure 2-23 Typical Four-Quadrant Gate At-Grade Crossing 2-26
Figure 2-24 Typical Cross Section of Overhead Contact System 2-28
Figure 2-25 Typical Cross Section of OCS Strain Gantry 2-28
Figure 2-26 Traction Power Substation 2-29

Figure 2-27 Traction Power Switching Station 2-30
Figure 2-28 Traction Power Paralleling Station 2-30
Figure 2-29 Typical Cross Section of At-Grade Profile with Traction Power, Signaling, and Train-Control Features 2-32
Figure 2-30 Alignment Alternatives Carried Forward into EIR/EIS as Identified in the Preliminary Alternatives Analysis Report 2-39
Figure 2-31 VTA's FY18-19 Transit Service Plan Proposed Service in San Jose, Morgan Hill, and Gilroy 2-48
Figure 2-32 Weekday Commuter Service between Merced and Los Banos 2-49
Figure 2-33 Overview Map of Design Options by Subsection 2-52
Figure 2-34 San Jose Diridon Station Approach Subsection 2-54
Figure 2-35 Monterey Corridor Subsection 2-55
Figure 2-36 Morgan Hill and Gilroy Subsection 2-56
Figure 2-37 Pacheco Pass Subsection 2-57
Figure 2-38 San Joaquin Valley Subsection 2-58
Figure 2-39 Representative HSR Infrastructure Considerations 2-62
Figure 2-40 At-Grade Cross-Section Configuration for UPRR Adjacency 2-64
Figure 2-41 Viaduct Cross-Section Configuration for UPRR Adjacency 2-64
Figure 2-42 South Gilroy Maintenance of Way Facility (Alternatives 1 and 2) 2-69
Figure 2-43 South Gilroy Maintenance of Way Facility (Alternative 4) 2-69
Figure 2-44 East Gilroy Maintenance of Way Facility (Alternative 3) 2-70
Figure 2-45 Maintenance of Way Siding near Turner Island Road 2-71
Figure 2-46 Location of State Highways or Routes Affected by HSR Alternatives 2-74
Figure 2-47 Local Roadway Modifications Required for HSR—San Jose Diridon Station Approach Subsection 2-75
Figure 2-48 Local Roadway Modifications Required for HSR—Monterey Corridor Subsection 2-76
Figure 2-49 Local Roadway Modifications Required for HSR—Morgan Hill and Gilroy Subsection (Northern Section) 2-77
Figure 2-50 Local Roadway Modifications Required for HSR—Morgan Hill and Gilroy Subsection (Southern Section) 2-78
Figure 2-51 Local Roadway Modifications Required for HSR—Pacheco Pass Subsection 2-79
Figure 2-52 Local Roadway Modifications Required for HSR—San Joaquin Valley Subsection 2-80
Figure 2-53 Alternative 1 Proposed Alignment 2-85
Figure 2-54 Conceptual San Jose Diridon Aerial Station Plan (Alternatives 1 and 3) 2-89
Figure 2-55 Conceptual San Jose Diridon Aerial Station Cross Section (Alternatives 1 and 3) 2-90
Figure 2-56 Extent of Tunnel Design Variant 2-95
Figure 2-57 Conceptual Downtown Gilroy Aerial Station Plan (Alternative 1) 2-98

Figure 2-58 Cross Section of Downtown Gilroy Aerial Station (Alternative 1).....2-99
Figure 2-59 Alternative 2 Proposed Alignment 2-105
Figure 2-60 Conceptual Downtown Gilroy Embankment Station Plan (Alternative 2).....2-113
Figure 2-61 Cross Section of Downtown Gilroy Embankment Station (Alternative 2).....2-114
Figure 2-62 Alternative 3 Proposed Alignment 2-117
Figure 2-63 Conceptual East Gilroy Station Plan (Alternative 3) 2-121
Figure 2-64 Cross Section of East Gilroy Station.....2-122
Figure 2-65 Alternative 4 Proposed Alignment 2-124
Figure 2-66 Conceptual San Jose Diridon At-Grade Station Plan (Alternative 4).....2-127
Figure 2-67 Extent of Diridon Design Variant.....2-128
Figure 2-68 Conceptual Downtown Gilroy At-Grade Station Plan (Alternative 4).....2-134
Figure 2-69 Typical Precasting Yard Layout.....2-152
Figure 2-70 Expected Haul Distances by Equipment Type.....2-155
Figure 2-71 Typical Aerial Structure Components 2-156
Figure 2-72 Full-Span Precast Construction on Taiwan HSR.....2-158
Figure 2-73 Span-by-Span Precast Segmental Construction 2-158
Figure 2-74 Balanced Cantilever Segmental Construction 2-158
Figure 2-75 Cast-in-Place Construction on Formwork 2-158
Figure 2-76 Locations of Tunnels along the Alternatives 2-159
Figure 2-77 Tunnel Boring Machine.....2-160
Figure 2-78 Tunnel Boring Machines at Double Portal Entrance.....2-160
Figure 2-79 Phasing of San Jose Diridon Station for Alternative 4 2-164
Figure 3.1-1 Typical Resource Study Area 3.1-8
Figure 3.2-1 Regionally Significant Freeways, Expressways, and Arterial Roadways.....3.2-22
Figure 3.2-2 Monterey Corridor Freeway Segments.....3.2-23
Figure 3.2-3 Gilroy Freeway Segments 3.2-24
Figure 3.2-4a Parking near San Jose Diridon Station and SAP Center (Off-Street within 1/2 mile).....3.2-28
Figure 3.2-4b Parking near San Jose Diridon Station and SAP Center (Off-Street within 1/3 mile).....3.2-29
Figure 3.2-4c Parking near San Jose Diridon Station and SAP Center (On-Street within 1/2 mile).....3.2-30
Figure 3.2-4d Parking near San Jose Diridon Station and SAP Center (On-Street within 1/3 mile).....3.2-31
Figure 3.2-5 San Jose Diridon Station Existing Transit Routes 3.2-35
Figure 3.2-6 Gilroy Station Existing Transit Routes 3.2-36
Figure 3.2-7 San Jose Diridon Station Existing Bicycle Facilities 3.2-38
Figure 3.2-8 Gilroy Station Existing Bicycle Facilities 3.2-40

Figure 3.2-9 Railroad Control Points and Subdivisions in the RSA (San Jose Diridon Station Approach Subsection) 3.2-42
Figure 3.2-10 Railroad Control Points and Subdivisions in the RSA (Morgan Hill and Gilroy and Pacheco Pass Subsections) 3.2-43
Figure 3.2-11a Summary of 2040 with Project Transportation Effects by Subsection before Mitigation 3.2-118
Figure 3.2-11b Summary of 2040 with Project Transportation Effects by Subsection after Mitigation 3.2-119
Figure 3.3-1 Aggregate GHG Emissions Reductions That Would Result from the California High-Speed Rail Project 3.3-11
Figure 3.3-2 Resource Study Area Air Basins and Air Districts 3.3-14
Figure 3.3-3 Monitoring Station Locations 3.3-38
Figure 3.3-4 Sensitive Receptor Locations within 1,000 Feet of the San Jose Diridon Station 3.3-42
Figure 3.3-5 Sensitive Receptor Locations within 1,000 Feet of the Downtown Gilroy Station 3.3-43
Figure 3.3-6 Sensitive Receptor Locations within 1,000 Feet of the East Gilroy Station 3.3-44
Figure 3.3-7 Sensitive Receptor Locations within 1,000 Feet of the East Gilroy Maintenance of Way Facility 3.3-45
Figure 3.4-1 Typical A-Weighted Maximum Sound Levels 3.4-5
Figure 3.4-2 Propagation of Ground-Borne Vibration into Buildings 3.4-6
Figure 3.4-3 State of California Land Use Compatibility Guidelines 3.4-10
Figure 3.4-4 Allowable Increase in Cumulative Noise Levels (Land Use Categories 1 and 2) 3.4-18
Figure 3.4-5 Allowable Increase in Cumulative Noise Levels (Land Use Category 3) 3.4-18
Figure 3.4-6 Distance from Tracks within which Startle Can Occur for HSR 3.4-19
Figure 3.4-7 Existing Vibration Measurement Levels 3.4-35
Figure 3.4-8 2040 Plus Project Noise Impacts—Alternative 1 (San Jose Diridon Station Approach Subsection) 3.4-48
Figure 3.4-9 2040 Plus Project Noise Impacts—Alternative 1 (Monterey Corridor Subsection) 3.4-49
Figure 3.4-10a 2040 Plus Project Noise Impacts—Alternative 1 without the Tunnel Design Variant (Morgan Hill and Gilroy Subsection) 3.4-50
Figure 3.4-10b 2040 Plus Project Noise Impacts—Alternative 1 with the Tunnel Design Variant (Morgan Hill and Gilroy Subsection) 3.4-51
Figure 3.4-11a 2040 Plus Project Noise Impacts—Alternatives 1, 2, 3, and 4 without the Tunnel Design Variant (Pacheco Pass Subsection) 3.4-52
Figure 3.4-11b 2040 Plus Project Noise Impacts—Alternatives 1, 2, 3, and 4 with the Tunnel Design Variant (Pacheco Pass Subsection) 3.4-53
Figure 3.4-12a 2040 Plus Project Noise Impacts—Alternatives 1, 2, 3, and 4 without the Tunnel Design Variant (San Joaquin Valley Subsection) 3.4-54
Figure 3.4-12b 2040 Plus Project Noise Impacts—Alternatives 1, 2, 3, and 4 with the Tunnel Design Variant (San Joaquin Valley Subsection) 3.4-55

Figure 3.4-13 2040 Plus Project Noise Impacts—Alternative 2 (San Jose Diridon Station Approach Subsection) 3.4-56
Figure 3.4-14 2040 Plus Project Noise Impacts—Alternative 2 (Monterey Corridor Subsection) 3.4-57
Figure 3.4-15a 2040 Plus Project Noise Impacts—Alternative 2 without the Tunnel Design Variant (Morgan Hill and Gilroy Subsection) 3.4-58
Figure 3.4-15b 2040 Plus Project Noise Impacts—Alternative 2 with the Tunnel Design Variant (Morgan Hill and Gilroy Subsection) 3.4-59
Figure 3.4-16 2040 Plus Project Noise Impacts—Alternative 3 (San Jose Diridon Station Approach Subsection) 3.4-60
Figure 3.4-17 2040 Plus Project Noise Impacts—Alternative 3 (Monterey Corridor Subsection) 3.4-61
Figure 3.4-18a 2040 Plus Project Noise Impacts—Alternative 3 without the Tunnel Design Variant (Morgan Hill and Gilroy Subsection) 3.4-62
Figure 3.4-18b 2040 Plus Project Noise Impacts—Alternative 3 with the Tunnel Design Variant (Morgan Hill and Gilroy Subsection) 3.4-63
Figure 3.4-19 2040 Plus Project Noise Impacts—Alternative 4 (San Jose Diridon Station Approach Subsection) 3.4-64
Figure 3.4-20 2040 Plus Project Noise Impacts—Alternative 4 (Monterey Corridor Subsection) 3.4-65
Figure 3.4-21a 2040 Plus Project Noise Impacts—Alternative 4 without the Tunnel Design Variant (Morgan Hill and Gilroy Subsection) 3.4-66
Figure 3.4-21b 2040 Plus Project Noise Impacts—Alternative 4 with the Tunnel Design Variant (Morgan Hill and Gilroy Subsection) 3.4-67
Figure 3.4-22 2029 and 2040 Plus Project Vibration Impacts—Alternative 1 (San Jose Diridon Station Approach Subsection) 3.4-79
Figure 3.4-23 2029 and 2040 Plus Project Vibration Impacts—Alternative 1 (Monterey Corridor Subsection) 3.4-80
Figure 3.4-24 2029 and 2040 Plus Project Vibration Impacts—Alternative 2 (San Jose Diridon Station Approach Subsection) 3.4-81
Figure 3.4-25 2029 and 2040 Plus Project Vibration Impacts—Alternative 2 (Monterey Corridor Subsection) 3.4-82
Figure 3.4-26 2029 and 2040 Plus Project Vibration Impacts—Alternative 2 (Morgan Hill and Gilroy Subsection) 3.4-83
Figure 3.4-27 2029 and 2040 Plus Project Vibration Impacts—Alternative 3 (San Jose Diridon Station Approach Subsection) 3.4-84
Figure 3.4-28 2029 and 2040 Plus Project Vibration Impacts—Alternative 3 (Monterey Corridor Subsection) 3.4-85
Figure 3.4-29 2029 and 2040 Plus Project Vibration Impacts—Alternative 4 (San Jose Diridon Station Approach Subsection) 3.4-86
Figure 3.4-30 2029 and 2040 Plus Project Vibration Impacts—Alternative 4 (Monterey Corridor Subsection) 3.4-87
Figure 3.4-31 2029 and 2040 Plus Project Vibration Impacts—Alternative 4 (Morgan Hill and Gilroy Subsection) 3.4-88
Figure 3.4-32 Example of a Typical Noise Barrier 3.4-93

Figure 3.4-33 Proposed Noise Barriers and Residual Noise Impacts—Alternative 1 (San Jose Diridon Station Approach Subsection) 3.4-104
Figure 3.4-34 Proposed Noise Barriers and Residual Noise Impacts—Alternative 1 (Monterey Corridor Subsection) 3.4-105
Figure 3.4-35a Proposed Noise Barriers and Residual Noise Impacts—Alternative 1 without the Tunnel Design Variant (Morgan Hill and Gilroy Subsection) 3.4-106
Figure 3.4-35b Proposed Noise Barriers and Residual Noise Impacts—Alternative 1 with the Tunnel Design Variant (Morgan Hill and Gilroy Subsection) 3.4-107
Figure 3.4-36 Proposed Noise Barriers and Residual Noise Impacts—Alternative 2 (Monterey Corridor Subsection) 3.4-108
Figure 3.4-37a Proposed Noise Barriers and Residual Noise Impacts—Alternative 2 without the Tunnel Design Variant (Morgan Hill and Gilroy Subsection) 3.4-109
Figure 3.4-37b Proposed Noise Barriers and Residual Noise Impacts—Alternative 2 with the Tunnel Design Variant (Morgan Hill and Gilroy Subsection) 3.4-110
Figure 3.4-38 Proposed Noise Barriers and Residual Noise Impacts—Alternative 3 (Monterey Corridor Subsection) 3.4-111
Figure 3.4-39 Proposed Noise Barriers and Residual Noise Impacts—Alternative 4 (San Jose Diridon Station Approach Subsection) 3.4-112
Figure 3.4-40 Proposed Noise Barriers and Residual Noise Impacts—Alternative 4 (Monterey Corridor Subsection) 3.4-113
Figure 3.4-41a Proposed Noise Barriers and Residual Noise Impacts—Alternative 4 without the Tunnel Design Variant (Morgan Hill and Gilroy Subsection) 3.4-114
Figure 3.4-41b Proposed Noise Barriers and Residual Noise Impacts—Alternative 4 with the Tunnel Design Variant (Morgan Hill and Gilroy Subsection) 3.4-115
Figure 3.4-42 Proposed Noise Barriers with Quiet Zones and Residual Noise Impacts—Alternative 4 (San Jose Diridon Station Approach Subsection) 3.4-116
Figure 3.4-43 Proposed Noise Barriers with Quiet Zones and Residual Noise Impacts—Alternative 4 (Monterey Corridor Subsection) 3.4-117
Figure 3.4-44a Proposed Noise Barriers with Quiet Zones and Residual Noise Impacts—Alternative 4 without the Tunnel Design Variant (Morgan Hill and Gilroy Subsection) 3.4-118
Figure 3.4-44b Proposed Noise Barriers with Quiet Zones and Residual Noise Impacts—Alternative 4 with the Tunnel Design Variant (Morgan Hill and Gilroy Subsection) 3.4-119
Figure 3.5-1 EMF Measurement Site Locations with Existing Sources of EMF and EMI: San Jose Diridon Station Approach Subsection 3.5-18
Figure 3.5-2 EMF Measurement Site Locations with Existing Sources of EMF and EMI: Monterey Corridor Subsection 3.5-19
Figure 3.5-3 EMF Measurement Site Locations with Existing Sources of EMF and EMI: Morgan Hill and Gilroy Subsection 3.5-20

Figure 3.5-4 EMF Measurement Site Locations with Existing Sources of EMF and EMI: Pacheco Pass Subsection 3.5-21
Figure 3.5-5 EMF Measurement Site Locations with Existing Sources of EMF and EMI: San Joaquin Valley Subsection 3.5-22
Figure 3.6-1 Electric Transmission Lines, Power Lines, and Substations in the Resource Study Area 3.6-24
Figure 3.6-2 Major Natural Gas Pipelines in the Resource Study Area 3.6-25
Figure 3.6-3 Major Petroleum Pipelines in the Resource Study Area 3.6-26
Figure 3.6-4 Potable Water Distribution System Boundaries 3.6-29
Figure 3.6-5 Agricultural Irrigation District Water System Boundaries 3.6-30
Figure 3.6-6 California Energy Consumption by Sector, 2015 ..... 3.6-44
Figure 3.6-7 California Energy Consumption Estimates by Type, 2015 ..... 3.6-44
Figure 3.6-8 Historical Trends and Projected Statewide Annual Electricity Consumption – Base Demand 3.6-47
Figure 3.6-9 Historical Trends and Projected Statewide Annual Electricity Consumption –Peak Demand 3.6-48
Figure 3.6-10 California Natural Gas Demand by Sector in 2016 ..... 3.6-49
Figure 3.6-11 Proposed HSR Electrical Components—San Jose Diridon Station Approach Subsection 3.6-63
Figure 3.6-12 Proposed HSR Electrical Components—Monterey Corridor Subsection 3.6-64
Figure 3.6-13 Proposed HSR Electrical Components—Morgan Hill and Gilroy Subsection 3.6-65
Figure 3.6-14 Proposed HSR Electrical Components—Pacheco Pass Subsection 3.6-66
Figure 3.6-15 Proposed HSR Electrical Components—San Joaquin Valley Subsection 3.6-67
Figure 3.7-1 Schematic of Biological Resource Study Areas 3.7-21
Figure 3.7-2 Regional RSA, Ecoregion, and County Boundaries 3.7-22
Figure 3.7-3 Watersheds and Major Hydrological Features of the San Jose to Central Valley Wye Project Extent 3.7-37
Figure 3.7-4 Wildlife Corridors within the Regional RSA 3.7-55
Figure 3.7-5 Protected Lands and Conservation Planning Boundaries in the Regional RSA 3.7-59
Figure 3.7-6 Area of Conservation Significance in the San Joaquin Valley 3.7-60
Figure 3.8-1 Planning Watersheds in the Surface Water Resource Study Area 3.8-14
Figure 3.8-2 Groundwater Subbasins in the Groundwater Resource Study Area 3.8-15
Figure 3.8-3 Waterbodies in the Resource Study Area 3.8-26
Figure 3.8-4 Water Quality Impairments in the Resource Study Area 3.8-30
Figure 3.8-5 Groundwater Recharge in the Santa Clara and Llagas Area Subbasins 3.8-33
Figure 3.8-6 FEMA Floodplains in the Resource Study Area 3.8-40

Figure 3.8-7 Comparison of the Existing FEMA 100-Year Floodplain and Existing 100-Year Floodplain from Hydraulic Model 3.8-41
Figure 3.8-8 Existing 100-Year Water Surface Elevations from ICM Hydraulic Model 3.8-42
Figure 3.8-9 Permanent Impacts of South Gilroy MOWFs on Existing Waterbodies and Wetlands—Alternatives 1, 2, and 4 ..... 3.8-52
Figure 3.8-10 Permanent Impacts of East Gilroy MOWF on Existing Waterbodies and Wetlands—Alternative 3 ..... 3.8-53
Figure 3.8-11 Permanent Impacts on Existing Waterbodies and Wetlands near Tunnel 1—Alternatives 1, 2, 3, and 4 ..... 3.8-54
Figure 3.8-12 Groundwater and Surface Water Resources That May Be Affected during Tunnel 1 Construction, Morgan Hill and Gilroy Subsection 3.8-95
Figure 3.8-13 Groundwater and Surface Water Resources That May Be Affected during Tunnel 2 Construction (western portion) 3.8-96
Figure 3.8-14 Groundwater and Surface Water Resources That May Be Affected during Tunnel 2 Construction (central portion) 3.8-97
Figure 3.8-15. Groundwater and Surface Water Resources That May Be Affected during Tunnel 2 Construction (eastern portion) 3.8-98
Figure 3.8-16 Hydraulic Model Overview and Proposed Bridge over Llagas Creek near East Gilroy under Alternative 3 ..... 3.8-108
Figure 3.8-17 Embankment Cross Section in Soap Lake Floodplain 3.8-112
Figure 3.8-18 Impacts on the Soap Lake Floodplain under Alternative 1, Morgan Hill and Gilroy Subsection 3.8-114
Figure 3.8-19 Impacts on the Soap Lake Floodplain under Alternative 2, Morgan Hill and Gilroy Subsection 3.8-115
Figure 3.8-20 Impacts on the Soap Lake Floodplain under Alternative 3, Morgan Hill and Gilroy Subsection 3.8-116
Figure 3.8-21 Impacts on the Soap Lake Floodplain under Alternative 4, Morgan Hill and Gilroy Subsection 3.8-117
Figure 3.9-1a San Jose Diridon Station Approach Subsection—Geologic Map 3.9-17
Figure 3.9-1b Monterey Corridor Subsection—Geologic Map 3.9-18
Figure 3.9-1c Morgan Hill and Gilroy Subsection—Geologic Map 3.9-19
Figure 3.9-1d Pacheco Pass Subsection—Geologic Map 3.9-20
Figure 3.9-1e San Joaquin Valley Subsection—Geologic Map 3.9-21
Figure 3.9-2 San Joaquin Valley Land Subsidence 3.9-31
Figure 3.9-3 Summary Distribution of Slides and Earth Flows in Santa Clara County 3.9-33
Figure 3.9-4 Significant Landslides in Morgan Hill and Gilroy and Pacheco Pass Subsections 3.9-34
Figure 3.9-5 Potentially Expansive Soil 3.9-37
Figure 3.9-6 U.S. Department of Agriculture Mapped Soil Corrosion of Steel 3.9-39
Figure 3.9-7 U.S. Department of Agriculture Mapped Soil Corrosion of Concrete 3.9-40
Figure 3.9-8 Regional Faulting 3.9-42

Figure 3.9-9 Liquefaction Susceptibility in Santa Clara County 3.9-44
Figure 3.9-10 Dams Located near Proposed Alignments 3.9-46
Figure 3.10-1 Adjacent Land Uses along the Project Extent..... 3.10-11
Figure 3.10-2 PEC Sites and Educational Facilities—San Jose Diridon Station Approach Subsection 3.10-13
Figure 3.10-3 PEC Sites and Educational Facilities—Monterey Corridor Subsection..... 3.10-14
Figure 3.10-4 PEC Sites and Educational Facilities—Morgan Hill and Gilroy Subsection..... 3.10-15
Figure 3.10-5 PEC Sites and Educational Facilities—Pacheco Pass Subsection..... 3.10-16
Figure 3.10-6 PEC Sites and Educational Facilities—San Joaquin Valley Subsection..... 3.10-17
Figure 3.11-1 San Jose Diridon Station Approach Subsection: Safety and Security Resource Study Area and Existing Conditions..... 3.11-20
Figure 3.11-2 Monterey Corridor Subsection: Safety and Security Resource Study Area and Existing Conditions 3.11-21
Figure 3.11-3 Morgan Hill and Gilroy Subsection: Safety and Security Resource Study Area and Existing Conditions..... 3.11-22
Figure 3.11-4 Pacheco Pass Subsection: Safety and Security Resource Study Area and Existing Conditions 3.11-23
Figure 3.11-5 San Joaquin Valley Subsection: Safety and Security Resource Study Area and Existing Conditions 3.11-24
Figure 3.11-6 Proposed Road Configuration for San Jose Fire Station 18—Skyway Drive Variant A..... 3.11-48
Figure 3.11-7 Proposed Road Configuration for San Jose Fire Station 18—Skyway Drive Variant B..... 3.11-49
Figure 3.11-8 Proposed Road Configuration for Morgan Hill Charter School—Alternative 1 ..... 3.11-50
Figure 3.11-9 Proposed Road Configuration for Morgan Hill Charter School—Alternative 2 ..... 3.11-51
Figure 3.11-10 Fire Station Emergency Vehicle Response Times..... 3.11-57
Figure 3.11-11 Fire Hazards—Morgan Hill and Gilroy Subsection 3.11-82
Figure 3.11-12 Fire Hazards—Pacheco Pass Subsection 3.11-83
Figure 3.12-1 Communities in the RSA..... 3.12-20
Figure 3.12-2 Community Facilities in the San Jose Diridon Station Approach Subsection..... 3.12-23
Figure 3.12-3 Community Facilities in the Monterey Corridor Subsection 3.12-25
Figure 3.12-4 Community Facilities in the Morgan Hill and Gilroy Subsection..... 3.12-27
Figure 3.12-5 Community Facilities in the Pacheco Pass Subsection 3.12-29
Figure 3.12-6 Community Facilities in the San Joaquin Valley Subsection 3.12-30
Figure 3.12-7 Wildlife Areas and Private Recreational Use in the Grasslands Ecological Area 3.12-38

Figure 3.12-8 Noise Contours Relative to Wildlife Areas and Private Hunting Clubs 3.12-97
Figure 3.13-1 Existing Land Uses – San Jose Diridon Station Area 3.13-10
Figure 3.13 2 Existing Land Uses—Downtown Gilroy Station Area (Alternatives 1, 2, and 4) 3.13-13
Figure 3.13-3a Existing Land Uses—South Gilroy MOWF (Alternatives 1 and 2) 3.13-14
Figure 3.13-3b Existing Land Uses—South Gilroy MOWF (Alternative 4) 3.13-15
Figure 3.13-4 Existing Land Uses—East Gilroy Station Area (Alternative 3) 3.13-17
Figure 3.13-5 Existing Land Uses—East Gilroy MOWF (Alternative 3) 3.13-18
Figure 3.13-6 Existing Land Uses—MOWS near Turner Island Road (All Project Alternatives) 3.13-19
Figure 3.13-7 Planned Land Uses (Current Zoning)—San Jose Diridon Station RSA 3.13-21
Figure 3.13-8 Planned Land Uses (Current Zoning)—Downtown Gilroy Station RSA 3.13-22
Figure 3.13-9a Planned Land Uses (Current Zoning)—South Gilroy MOWF RSA (Alternatives 1 and 2) 3.13-23
Figure 3.13-9b Planned Land Uses (Current Zoning)—South Gilroy MOWF RSA (Alternative 4) 3.13-24
Figure 3.13-10 Planned Land Uses (Current Zoning)—East Gilroy Station RSA 3.13-29
Figure 3.13-11 Planned Land Uses (Current Zoning)—East Gilroy MOWF RSA 3.13-30
Figure 3.13-12 Planned Land Uses (Zoning)—MOWS near Turner Island Road RSA 3.13-32
Figure 3.14-1 Agricultural Lands in Santa Clara, San Benito, and Merced Counties 3.14-17
Figure 3.14-2a Important Farmland in the Monterey Corridor Subsection 3.14-20
Figure 3.14-2b Important Farmland in the Morgan Hill and Gilroy Subsection 3.14-21
Figure 3.14-2c Important Farmland in the Pacheco Pass Subsection 3.14-22
Figure 3.14-2d Important Farmland in the San Joaquin Valley Subsection 3.14-23
Figure 3.14-3a Farmland Protected under Williamson Act in the Monterey Corridor Subsection 3.14-26
Figure 3.14-3b Farmland Protected under Williamson Act in the Morgan Hill and Gilroy Subsection 3.14-27
Figure 3.14-3c Farmland Protected under Williamson Act in the Pacheco Pass Subsection 3.14-28
Figure 3.14-3d Farmland Protected under Williamson Act in the San Joaquin Valley Subsection 3.14-29
Figure 3.14-4a Conservation Easements with Permanent Impacts on Important Farmland (Sheet 1 of 5) 3.14-33
Figure 3.14-4b Conservation Easements with Permanent Impacts on Important Farmland (Sheet 2 of 5) 3.14-34

Figure 3.14-4c Conservation Easements with Permanent Impacts on Important Farmland (Sheet 3 of 5) 3.14-35
Figure 3.14-4d Conservation Easements with Permanent Impacts on Important Farmland (Sheet 4 of 5) 3.14-36
Figure 3.14-4e Conservation Easements with Permanent Impacts on Important Farmland (Sheet 5 of 5) 3.14-37
Figure 3.14-5 Important Farmland Remnant Parcels and Important Farmland Mitigation Ratios 3.14-53
Figure 3.15-1 Parks, Recreation, Open Space Resources, and School District Play Areas—San Jose Diridon Station Approach Subsection (north) 3.15-11
Figure 3.15-2 Parks, Recreation, Open Space Resources, and School District Play Areas—San Jose Diridon Station Approach Subsection (south) 3.15-12
Figure 3.15-3 Parks, Recreation, Open Space Resources, and School District Play Areas—Monterey Corridor Subsection 3.15-13
Figure 3.15-4 Parks, Recreation, Open Space Resources, and School District Play Areas—Morgan Hill and Gilroy Subsection (north) 3.15-14
Figure 3.15-5 Parks, Recreation, Open Space Resources, and School District Play Areas—Morgan Hill and Gilroy Subsection (central) 3.15-15
Figure 3.15-6 Parks, Recreation, Open Space Resources, and School District Play Areas—Morgan Hill and Gilroy Subsection (south) 3.15-16
Figure 3.15-7 Parks, Recreation, Open Space Resources, and School District Play Areas—Pacheco Pass Subsection 3.15-17
Figure 3.15-8 Parks, Recreation, Open Space Resources, and School District Play Areas—San Joaquin Valley Subsection 3.15-18
Figure 3.15-9 Permanent Acquisition at Reed Street Dog Park—Alternatives 2 and 3 ..... 3.15-74
Figure 3.15-10 Permanent Acquisition at Reed and Grant Streets Sports Park—Alternatives 2 and 3 ..... 3.15-75
Figure 3.15-11 Permanent Acquisition at Guadalupe River Trail (Reach 6)—Alternatives 1, 2, and 3 ..... 3.15-76
Figure 3.15-12 Permanent Acquisition at Los Gatos Creek Trail—Alternatives 1, 2, and 3 ..... 3.15-77
Figure 3.15-13 Permanent Acquisition at Los Gatos Creek Trail—Alternative 4 ..... 3.15-78
Figure 3.15-14 Permanent Acquisition at Fuller Park—Alternative 4 ..... 3.15-79
Figure 3.15-15 Permanent Acquisition of Highway 87 Bikeway North—Alternatives 1, 2, and 3 (north) 3.15-80
Figure 3.15-16 Permanent Acquisition of Highway 87 Bikeway North—Alternatives 1, 2, and 3 (south) 3.15-81
Figure 3.15-17 Permanent Acquisition of Highway 87 Bikeway North—Alternative 4 (north) 3.15-82
Figure 3.15-18 Permanent Acquisition of Highway 87 Bikeway North—Alternative 4 (south) 3.15-83

Figure 3.15-19 Permanent Acquisition at Tamien Park—Alternatives 1, 2, and 3 ..... 3.15-84
Figure 3.15-20 Permanent Acquisition of Three Creeks Trail (Phase II Planned)—Alternatives 1, 2, and 3 ..... 3.15-85
Figure 3.15-21 Permanent Acquisition of Three Creeks Trail (Phase II Planned)—Alternative 4 ..... 3.15-86
Figure 3.15-22 Permanent Acquisition of Coyote Creek Parkway County Park—Alternatives 1 and 3 (part 1 of 4) 3.15-87
Figure 3.15-23 Permanent Acquisition of Coyote Creek Parkway County Park—Alternatives 1 and 3 (part 2 of 4) 3.15-88
Figure 3.15-24 Permanent Acquisition of Coyote Creek Parkway County Park—Alternatives 1 and 3 (part 3 of 4) 3.15-89
Figure 3.15-25 Permanent Acquisition of Coyote Creek Parkway County Park—Alternatives 1 and 3 (part 4 of 4) 3.15-90
Figure 3.15-26 Permanent Acquisition of Coyote Creek Parkway County Park—Alternative 2 (part 1 of 5) 3.15-91
Figure 3.15-27 Permanent Acquisition of Coyote Creek Parkway County Park—Alternative 2 (part 2 of 5) 3.15-92
Figure 3.15-28 Permanent Acquisition of Coyote Creek Parkway County Park—Alternative 2 (part 3 of 5) 3.15-93
Figure 3.15-29 Permanent Acquisition of Coyote Creek Parkway County Park—Alternative 2 (part 4 of 5) 3.15-94
Figure 3.15-30 Permanent Acquisition of Coyote Creek Parkway County Park—Alternative 2 (part 5 of 5) 3.15-95
Figure 3.15-31 Permanent Acquisition of Coyote Creek Parkway County Park—Alternative 4 (part 1 of 4) 3.15-96
Figure 3.15-32 Permanent Acquisition of Coyote Creek Parkway County Park—Alternative 4 (part 2 of 4) 3.15-97
Figure 3.15-33 Permanent Acquisition of Coyote Creek Parkway County Park—Alternative 4 (part 3 of 4) 3.15-98
Figure 3.15-34 Permanent Acquisition of Coyote Creek Parkway County Park—Alternative 4 (part 4 of 4) 3.15-99
Figure 3.15-35 Permanent Acquisition of Coyote Creek Trail—Alternatives 1 and 3 ..... 3.15-100
Figure 3.15-36 Permanent Acquisition of Coyote Creek Trail—Alternative 2 ..... 3.15-101
Figure 3.15-37 Permanent Acquisition of Morgan Hill Community and Cultural Center—Alternative 2 ..... 3.15-102
Figure 3.15-38 Permanent Acquisition of San Martin/Gwinn Elementary School—Alternative 2 ..... 3.15-121
Figure 3.15-39 Permanent Acquisition of South Valley Middle School—Alternative 1 ..... 3.15-122
Figure 3.15-40 Permanent Acquisition of South Valley Middle School—Alternative 2 ..... 3.15-123
Figure 3.16-1 Project Alternatives, KVPs, and Regional Scenic Resources 3.16-8
Figure 3.16-2 Visual Effects 3.16-12

Figure 3.16-3 KVPs, Visual Resources, and Viewers in the Santa Clara Landscape Unit 3.16-15
Figure 3.16-4 KVPs, Visual Resources, and Viewers in the Diridon Station Landscape Unit 3.16-21
Figure 3.16-5 KVPs, Visual Resources, and Viewers in the San Jose Station Approach Landscape Unit 3.16-25
Figure 3.16-6 KVPs, Visual Resources, and Viewers in the Communications Hill Landscape Unit 3.16-31
Figure 3.16-7 KVPs, Visual Resources, and Viewers in the Monterey Highway San Jose Landscape Unit 3.16-35
Figure 3.16-8 KVPs, Visual Resources, and Viewers in the Coyote Valley Landscape Unit 3.16-40
Figure 3.16-9 KVPs, Visual Resources, and Viewers in the US 101 Landscape Unit 3.16-45
Figure 3.16-10 KVPs, Visual Resources, and Viewers in the Morgan Hill–San Martin Landscape Unit 3.16-49
Figure 3.16-11 KVPs, Visual Resources, and Viewers in the Downtown Gilroy Landscape Unit 3.16-54
Figure 3.16-12 KVPs, Visual Resources, and Viewers in the Pajaro–San Felipe Landscape Unit 3.16-59
Figure 3.16-13 KVPs, Visual Resources, and Viewers in the Pacheco Pass Landscape Unit 3.16-63
Figure 3.16-14 Visual Resources, and Viewers in the San Luis Landscape Unit 3.16-67
Figure 3.16-15 KVPs, Visual Resources, and Viewers in the Romero Landscape Unit 3.16-70
Figure 3.16-16 KVPs, Visual Resources, and Viewers in the Henry Miller Landscape Unit 3.16-74
Figure 3.16-17 KVP 1 Santa Clara Landscape Unit—Main Street: Existing, Baseline 2029, and Simulated Views 3.16-88
Figure 3.16-18 KVP 2 Santa Clara Landscape Unit—I-880: Existing, Baseline 2029, and Simulated Views 3.16-89
Figure 3.16-19 KVP 3 Santa Clara Landscape Unit—West Hedding Street: Existing, Baseline 2029, and Simulated Views 3.16-90
Figure 3.16-20 KVP 4 Diridon Station Landscape Unit—Caltrain from The Alameda: Existing, Baseline 2029, and Simulated Views 3.16-94
Figure 3.16-21 KVP 5 Diridon Station Landscape Unit—Caltrain from West Santa Clara Street: Existing, Baseline 2029, and Simulated Views 3.16-95
Figure 3.16-22 KVP 6 Diridon Station Landscape Unit—San Jose Diridon Station: Existing, Baseline 2029, and Simulated Views 3.16-96
Figure 3.16-23 KVP 7 San Jose Station Approach Landscape Unit—San Jose Skyline: Existing, Baseline 2029, and Simulated Views 3.16-98
Figure 3.16-24 KVP 8 San Jose Station Approach Landscape Unit—Gardner School: Existing, Baseline 2029, and Simulated Views 3.16-99
Figure 3.16-25 KVP 9 San Jose Station Approach Landscape Unit—Fuller Avenue: Existing, Baseline 2029, and Simulated Views 3.16-101

Figure 3.16-26 KVP 10 San Jose Station Approach Landscape Unit—Delmas Street: Existing, Baseline 2029, and Simulated Views 3.16-102
Figure 3.16-27 KVP 11 Communications Hill Landscape Unit—Communications Hill Park: Existing and Simulated Views 3.16-104
Figure 3.16-28 KVP 12 Monterey Highway San Jose Landscape Unit—Lick Quarry: Existing and Simulated Views 3.16-107
Figure 3.16-29 KVP 13 Monterey Highway San Jose Landscape Unit—Branham Lane: Existing and Simulated Views 3.16-108
Figure 3.16-30 KVP 14 Monterey Highway San Jose Landscape Unit—Edenvale Drive: Existing, Baseline 2029, and Simulated Views 3.16-109
Figure 3.16-31 KVP 15 Monterey Highway San Jose Landscape Unit—Avenida Rotella: Existing and Simulated Views 3.16-110
Figure 3.16-32 KVP 16 Coyote Valley Landscape Unit—Monterey Road Coyote Valley: Existing and Simulated Views 3.16-114
Figure 3.16-33 KVP 17 US 101 Landscape Unit—Walnut Grove: Existing and Simulated Views 3.16-118
Figure 3.16-34 KVP 18 US 101 Landscape Unit—East Dunne Avenue: Existing and Simulated Views 3.16-119
Figure 3.16-35 KVP 19 Morgan Hill–San Martin Landscape Unit—Peebles Avenue: Existing and Simulated Views 3.16-122
Figure 3.16-36 KVP 20 Morgan Hill–San Martin Landscape Unit—Caltrain Morgan Hill Station: Existing and Simulated Views 3.16-124
Figure 3.16-37 KVP 21 Morgan Hill San Martin Landscape Unit—San Martin: Existing and Simulated Views 3.16-125
Figure 3.16-38 KVP 22 Downtown Gilroy Landscape Unit—East 6th Street: Existing and Simulated Views 3.16-128
Figure 3.16-39 KVP 23 Downtown Gilroy Landscape Unit—Caltrain Gilroy Station: Existing and Simulated Views 3.16-129
Figure 3.16-40 KVP 24 Downtown Gilroy Landscape Unit—East 8th Street: Existing and Simulated Views 3.16-130
Figure 3.16-41 KVP 25 Pajaro–San Felipe Landscape Unit—Leavesley Road: Existing and Simulated Views 3.16-135
Figure 3.16-42 KVP 26 Pajaro–San Felipe Landscape Unit—SR 152 at Frazier Lake Road: Existing and Simulated Views 3.16-138
Figure 3.16-43 KVP 27 Pajaro–San Felipe Landscape Unit—San Felipe: Existing and Simulated Views 3.16-139
Figure 3.16-44 KVP 28 Pacheco Pass Landscape Unit—SR 152: Existing and Simulated Views 3.16-142
Figure 3.16-45 KVP 29 Pacheco Pass Landscape Unit—Casa de Fruta: Existing and Simulated Views 3.16-143
Figure 3.16-46 KVP 30 Pacheco Pass Landscape Unit—Pacheco Creek Valley: Existing and Simulated Views 3.16-144
Figure 3.16-47 KVP 31 Romero Landscape Unit—West Loop Road: Existing and Simulated Views 3.16-146
Figure 3.16-48 KVP 32 Romero Landscape Unit—Pomas Road: Existing and Simulated Views 3.16-148

Figure 3.16-49 KVP 33 Romero Landscape Unit—Interstate 5: Existing and Simulated Views 3.16-149
Figure 3.16-50 KVP 34 Henry Miller Landscape Unit—Volta: Existing and Simulated Views 3.16-151
Figure 3.16-51 KVP 35 Henry Miller Landscape Unit—Henry Miller Road: Existing and Simulated Views 3.16-152
Figure 3.16-52 KVP 33—Alternatives 1, 2, 3, and 4 Simulation 3.16-154
Figure 3.17-1 Potentially Affected Historic Built Environment Resource Locations—San Jose Diridon Station Approach Subsection 3.17-42
Figure 3.17-2 Potentially Affected Historic Built Environment Resource Locations—Monterrey Corridor Subsection 3.17-43
Figure 3.17-3 Potentially Affected Historic Built Environment Resource Locations—Morgan Hill and Gilroy Subsection 3.17-44
Figure 3.17-4 Potentially Affected Historic Built Environment Resource Locations—Pacheco Pass Subsection 3.17-45
Figure 3.17-5 Potentially Affected Historic Built Environment Resource Locations—San Joaquin Valley Subsection 3.17-46
Figure 4-1 HSR Alternatives by Subsection 4-16
Figure 4-2 Parks, Recreation, and Wildlife and Waterfowl Refuges—San Jose Diridon Station Approach Subsection (Northern Portion) 4-33
Figure 4-3 Parks, Recreation, and Wildlife and Waterfowl Refuges—San Jose Diridon Station Approach Subsection (Southern Portion) 4-34
Figure 4-4 Parks, Recreation, and Wildlife and Waterfowl Refuges—Monterey Corridor Subsection 4-35
Figure 4-5 Parks, Recreation, and Wildlife and Waterfowl Refuges—Morgan Hill and Gilroy Subsection (Northern Portion) 4-36
Figure 4-6 Parks, Recreation, and Wildlife and Waterfowl Refuges—Morgan Hill and Gilroy Subsection (Central Portion) 4-37
Figure 4-7 Parks, Recreation, and Wildlife and Waterfowl Refuges—Morgan Hill and Gilroy Subsection (Southern Portion) 4-38
Figure 4-8 Parks, Recreation, and Wildlife and Waterfowl Refuges—Pacheco Pass Subsection 4-39
Figure 4-9 Parks, Recreation, and Wildlife and Waterfowl Refuges—San Joaquin Valley Subsection 4-40
Figure 4-10 Built Historic Resources—San Jose Diridon Station Approach Subsection 4-45
Figure 4-11 Built Historic Resources—Morgan Hill and Gilroy Subsection (Northern Portion) 4-46
Figure 4-12 Built Historic Resources—Morgan Hill and Gilroy Subsection (North-Central Portion) 4-47
Figure 4-13 Built Historic Resources—Morgan Hill and Gilroy Subsection (Central Portion) 4-48
Figure 4-14 Built Historic Resources—Morgan Hill and Gilroy Subsection (Central-Southern Portion) 4-49

Figure 4-15 Built Historic Resources—Pacheco Pass Subsection (Western Portion) 4-50
Figure 4-16 Built Historic Resources—Pacheco Pass Subsection (Eastern Portion) 4-51
Figure 4-17 Built Historic Resources—San Joaquin Valley Subsection 4-52
Figure 4-18 Guadalupe River Park 4-106
Figure 4-19 Reed Street Dog Park 4-107
Figure 4-20 Reed and Grant Streets Sports Park 4-108
Figure 4-21 Larry J. Marsalli Park 4-109
Figure 4-22 Newhall Park 4-110
Figure 4-23 College Park 4-111
Figure 4-24 Theodore Lenzen Park 4-112
Figure 4-25 Cahill Park 4-113
Figure 4-26 Los Gatos Creek Trail 4-114
Figure 4-27 Guadalupe River Trail, Reach 6 4-115
Figure 4-28 Biebrach Park 4-116
Figure 4-29 Fuller Park 4-117
Figure 4-30 Tamien Park 4-118
Figure 4-31 Roberto Antonio Balermino Park 4-119
Figure 4-32 Communications Hill Trail 4-120
Figure 4-33 Edenvale Gardens Regional Park 4-121
Figure 4-34 Coyote Creek Parkway County Park (Part A) 4-122
Figure 4-35 Coyote Creek Parkway County Park (Part B) 4-123
Figure 4-36 Coyote Creek Parkway County Park (Part C) 4-124
Figure 4-37 Coyote Creek Parkway County Park (Part D) 4-125
Figure 4-38 Coyote Creek Parkway County Park (Part E) 4-126
Figure 4-39 Coyote Creek Parkway County Park (Part F) 4-127
Figure 4-40 Coyote Creek Trail (Part A) 4-128
Figure 4-41 Coyote Creek Trail (Part B) 4-129
Figure 4-41a Juan Bautista De Anza National Historic Trail (Alternatives 1 and 3 Viaduct, Alternative 2 Embankment, Alternative 4 Depressed Undercrossing) 4-130
Figure 4-42 Tulare Hill County Park 4-131
Figure 4-43 Field Sports County Park 4-132
Figure 4-44 Anderson Lake County Park 4-133
Figure 4-45 Sanchez Park 4-134
Figure 4-46 Villa Mira Monte 4-135
Figure 4-47 Railroad Park 4-136
Figure 4-48 Morgan Hill Community and Cultural Center 4-137
Figure 4-49 San Ysidro Park 4-138
Figure 4-50 Forest Street Park 4-139
Figure 4-51 Gilroy Sports Park 4-140

Figure 4-52 Cottonwood Creek Wildlife Area 4-141
Figure 4-53 Volta Wildlife Area 4-142
Figure 4-54 Los Banos Wildlife Area 4-143
Figure 4-55 Santa Clara Railroad Historical Complex 4-188
Figure 4-56 Southern Pacific Depot (Diridon Station/Hiram Cahill Depot) 4-189
Figure 4-57 Sunlite Baking Company 4-190
Figure 4-58 415 Illinois Avenue 4-191
Figure 4-59 Stevens/Fisher House 4-192
Figure 4-60 Barnhart House 4-193
Figure 4-61 Madrone Underpass 4-194
Figure 4-62 San Martin Winery 4-195
Figure 4-63 Japanese School 4-196
Figure 4-64 IOOF Orphanage Home 4-197
Figure 4-65 Gilroy City Hall 4-198
Figure 4-66 Live Oak Creamery 4-199
Figure 4-67 Millers Canal 4-200
Figure 4-68 California Aqueduct 4-201
Figure 4-69 Delta-Mendota Canal 4-202
Figure 4-70 San Joaquin and Kings River – Main Canal 4-203
Figure 4-71 Negra Ranch 4-204
Figure 4-72 Cozzi Family Property 4-205
Figure 5-1 Environmental Justice Reference Community and Resource Study Area 5-7
Figure 5-2 Population Density within the Environmental Justice Reference Community 5-8
Figure 5-3 Low-Income Populations in the Resource Study Area (Part 1 of 5) 5-21
Figure 5-4 Low-Income Populations in the Resource Study Area (Part 2 of 5) 5-22
Figure 5-5 Low-Income Populations in the Resource Study Area (Part 3 of 5) 5-23
Figure 5-6 Low-Income Populations in the Resource Study Area (Part 4 of 5) 5-24
Figure 5-7 Low-Income Populations in the Resource Study Area (Part 5 of 5) 5-25
Figure 5-8 Minority Population Distribution 5-29
Figure 5-9 Minority Populations in the Resource Study Area (Part 1 of 5) 5-30
Figure 5-10 Minority Populations in the Resource Study Area (Part 2 of 5) 5-31
Figure 5-11 Minority Populations in the Resource Study Area (Part 3 of 5) 5-32
Figure 5-12 Minority Populations in the Resource Study Area (Part 4 of 5) 5-33
Figure 5-13 Minority Populations in the Resource Study Area (Part 5 of 5) 5-34
Figure 5-14 Locations of Environmental Justice Outreach Activities 5-55
Figure 5-15 Adverse Transportation Effects during Construction (Alternatives 1, 2, and 3) 5-79
Figure 5-16 Adverse Visual Effects 5-86
Figure 5-17 Residential Displacements—Proportional Representation by Alternative and Community 5-90

Figure 5-18 Business Displacements—Proportional Representation by Alternative and Community 5-91
Figure 5-19 Adverse Effects on Parks, Recreation, and School District Play Areas 5-105
Figure 5-20 Adverse Transportation Effects During Operations After Mitigation (San Jose Diridon Station) 5-109
Figure 5-21 Adverse Transportation Effects During Operations After Mitigation (Monterey Corridor) 5-110
Figure 5-22 Adverse Transportation Effects During Operations After Mitigation (Morgan Hill and Gilroy) 5-111
Figure 5-23 Fire Station Emergency Vehicle Response Time Delay, Monterey Corridor (Alternative 4) 5-117
Figure 5-24 Fire Station Emergency Vehicle Response Time Delay, Morgan Hill and Gilroy (Alternative 4) 5-118
Figure 5-25 Mitigated Operational Noise Impacts (Noise Barriers)—Proportional Representation by Alternative and Community 5-124
Figure 5-26 Mitigated Operational Noise Impacts (Noise Barriers and Quiet Zones)—Proportional Representation by Alternative and Community 5-125
Figure 8-1 Preferred Alternative 8-3

SUMMARY

Since publication of the Draft Environmental Impact Report (EIR)/ Environmental Impact Statement (EIS), the following substantive changes have been made to this section:

- Section S.1.1, Modifications Since the Draft EIR/EIS, was added to provide a summary of changes made since the publication of the Draft EIR/EIS.
- Section S.3, Issues Raised during the Scoping Process, was revised to show the correct dates for the Notice of Preparation (NOP) and Notice of Intent (NOI).
- A footnote was added in Section S.5.1, No Project Alternative, regarding the updated Council on Environmental Quality (CEQ) regulations issued after release of the Draft EIR/EIS.
- Section S.5.2.1, Common Design Features, was revised to remove a bullet describing eliminating leg of intersections from a list of state highway and local roadway modifications.
- Section S.7, No Project Alternative Impacts, was updated to include descriptions of transportation and noise and vibration impacts under the No Project Alternative.
- The following impacts summarized in Table S-3 were updated: Impacts TR#3, TR#4, TR#5, TR#8, AQ#1, AQ#6, AQ#9, AQ#16, PUE#1, PUE#4, PUE#12, BIO#38, BIO#42, BIO#43, BIO#51, BIO#53, HYD#8, HYD#9, HYD#10, HYD#15, S&S#7, and AG#8. In addition, the following impact summaries related to socioeconomics and communities were updated: Permanent Displacement and Relocation of Residential Properties, Permanent Displacement and Relocation of Commercial and Industrial Facilities, Permanent Displacement and Relocation of Agricultural Properties, Construction Impacts on Employment, and Temporary Impact on Private Recreational Waterfowl Hunting. Impacts BIO#2b and BIO#26a were added.
- The following impacts summarized in Table S-4 were updated: Impacts TR#7, NV#2, NV#7, NV#10, EMF/EMI#2, PUE#13, BIO#44, BIO#45, BIO#46, BIO#47, S&S#9, LU#7, and PK#7. In addition, the following impact summaries related to socioeconomics and communities were updated: Disruption or Division of Established Communities from Changes to Noise and Vibration from HSR Operations, Operations Impacts on Employment, and Permanent Impact on Private Recreational Waterfowl Hunting. A table note was added to the Noise section to describe how impacts associated with the design variants are identified in the table.
- In Table S-5, Mitigation Measure TR-MM#2 was added as mitigation for Temporary Impacts on Bus Transit, and the California Environmental Quality Act (CEQA) level of significance after mitigation for each alternative was added. Mitigation Measure AQ-MM#1 and AQ-MM#2 were added as mitigation for all air quality and greenhouse gas (GHG) impacts that are significant before mitigation. Mitigation Measure AQ-MM#2: Offset Project Construction Emissions in the NCCAB was removed as mitigation for Temporary Direct Impacts on Implementation of an Applicable Air Quality Plan. Mitigation Measure BIO-MM#80 was added as mitigation for the impacts Intermittent Permanent Exposure of Sensitive Receptors to Noise from Train Operations and Permanent Changes from Noise and Vibration on Parks, Recreation, and Open Space Resource Character and Use. Additional detail on the CEQA level of significance after mitigation was added for the impact Intermittent Permanent Exposure of Sensitive Receptors to Vibration from Operations. The titles of BIO-MM#10, BIO-MM#14, BIO-MM#28, BIO-MM#84b, and BIO-MM#85 were updated. BIO-MM#77b was added as mitigation for impacts Permanent Impacts on Wildlife Movement and Conflict with Coyote Valley Linkage. BIO-MM#84a was added as mitigation for impacts Permanent Conversion or Degradation of Conservation Areas and Conflict with Santa Clara Valley Habitat Plan. The row for impact Alternatives 1 and 2: Permanent Impacts on Groundwater Quality and Volume during Construction was deleted. For the impact Continuous Permanent Impacts on Emergency Access and Response Times, Mitigation Measure SS-MM#3 was added for Alternatives 1, 2, and 3; SS-MM#4 was noted as for Alternatives 1, 2, and 3 in part and Alternative 4 in full; and TR-MM#1e, TR-MM#1t, TR-MM#1u, TR-MM#1w, TR-MM#1x.6,

TR-MM#1x.8, TR-MM#1x.9, and TR-MM#1x.10 were added for Alternative 4. For impact Alternative 3: Permanent Alteration of Land Use Patterns from Land Use Conversion and Introduction of Incompatible Uses, LU-MM#1 was removed and replaced with a statement that no mitigation measures are required for Alternatives 1, 2, and 4, and no mitigation measures have been identified for Alternative 3. Impact Alternatives 2 and 4: Temporary Changes from Noise, Vibration, and Construction Emissions on Use and User Experience of Parks, Recreational Facilities, and Open Space Resources was clarified to apply to Alternatives 2 and 4. For impact Temporary Changes to Access or Use of Parks, PR-MM#7 was clarified as applying to Alternatives 1, 2, and 3, and PR-MM#8 was added for Alternatives 2 and 3. PR-MM#8 was also added for impact Permanent Acquisition of Parks, Recreation, and Open Space Resources. Table note 4 was revised.

- In Table S-5, the CEQA Level of Significance after Mitigation was corrected for Impacts TR#10 and S&S#4.
- Revisions to Tables S-3, S-4, and S-5 were made to incorporate changes included in the *San Jose to Merced Project Section Revised Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement, Biological Resources Analysis* (Revised/Supplemental Draft EIR/EIS) and in response to public comments on the Revised/Supplemental Draft EIR/EIS.
- Table S-5 was modified to include the corresponding numbering for each impact title.
- Table S-6 was updated to reflect corrections in the number of significant and unavoidable impacts under each alternative.
- Table S-7 was updated for consistency with Chapter 6 of this Final EIR/EIS to reflect design changes and to reflect escalated costs in 2021 dollars.
- Table S-8 was updated to show community and environmental factors, including commercial displacements and severe noise impacts, impacted by the Diridon design variant (DDV) and tunnel design variant (TDV) in parentheses. Rows for vibration impacts and impacts related to intersections with adverse National Environmental Policy Act (NEPA) effects after mitigation were added to this table. The number of permanent adverse impacts on National Register of Historic Places–listed/eligible resources was updated for Alternatives 1 and 2. Environmental justice effects were updated to reflect the final determinations, taking into account direct mitigation, project benefits, and offsetting mitigation measures.
- Section S.8.3.5, Diridon and Tunnel Design Variants, was revised with clarifying detail, and subheadings were added to separate the description of the DDV and the TDV.
- The number of Section 4(f) properties was updated in Section S.9.1, Section 4(f).
- Draft EIR/EIS Section S.12.1, Public and Agency Comment, which addressed comments on the Draft EIR/EIS, was deleted.
- The dates for key project milestones were updated in Table S-9.
- Section S.10, Environmental Justice, was updated to reflect the final determinations, taking into account direct mitigation, project benefits, and offsetting mitigation measures.
- Where appropriate, the verb “would,” when used specifically to describe impact avoidance and minimization features (IAMFs) or mitigation measures, as well as their directly related activities, was changed to “will,” indicating their integration into project design.

S.1 Introduction and Background

The California High-Speed Rail Authority (Authority), a state governing board formed in 1996, has the responsibility of planning, designing, constructing, and operating the California High-Speed Rail (HSR) System. Its mandate is to develop an HSR system that coordinates with the state's existing transportation network, which includes intercity rail and bus lines, regional commuter rail lines, urban rail and bus transit lines, highways, and airports.

High-Speed Rail System

The system includes the HSR trains, guideways, structures, stations, traction power substations, and maintenance facilities.

The California HSR System will provide intercity, high-speed service on more than 800 miles of track throughout California, connecting the major population centers of Sacramento, the San Francisco Bay Area (Bay Area), the Central Valley, Los Angeles, the Inland Empire,[1] Orange County, and San Diego. Figure S-1 shows this system. California HSR System will use state-of-the-art, electrically powered, high-speed, steel-wheel-on-steel-rail technology, including contemporary safety, signaling, and automated train-control systems, with trains capable of operating up to 220 miles per hour (mph) over a dedicated track alignment.

The Authority plans to implement the California HSR System in two phases. Phase 1 will connect San Francisco to Los Angeles and Anaheim via the Pacheco Pass and the Central Valley with an express travel time of approximately 2 hours and 40 minutes. Phase 2 will connect the Central Valley to the state's capital, Sacramento, and will extend the system from Los Angeles to San Diego.

The San Jose to Merced Project Section (Project Section) would provide HSR service from Scott Boulevard, just north of the San Jose Diridon Station, to a station in downtown Merced. The Project Section consists of three separate portions: San Jose to Central Valley Wye, Central Valley Wye, and Ranch Road to Merced. The portion of the Project Section analyzed in this Final EIR/EIS is from Scott Boulevard, just north of San Jose Diridon Station, to Carlucci Road. This is referred to as the San Jose to Central Valley Wye Project Extent (project or project extent). It would extend approximately 90 miles, passing through Santa Clara, San Benito, and Merced Counties and the cities of Santa Clara, San Jose, Morgan Hill, Gilroy, and Los Banos. This Final EIR/EIS evaluates four alternatives shown in Figure S-2.

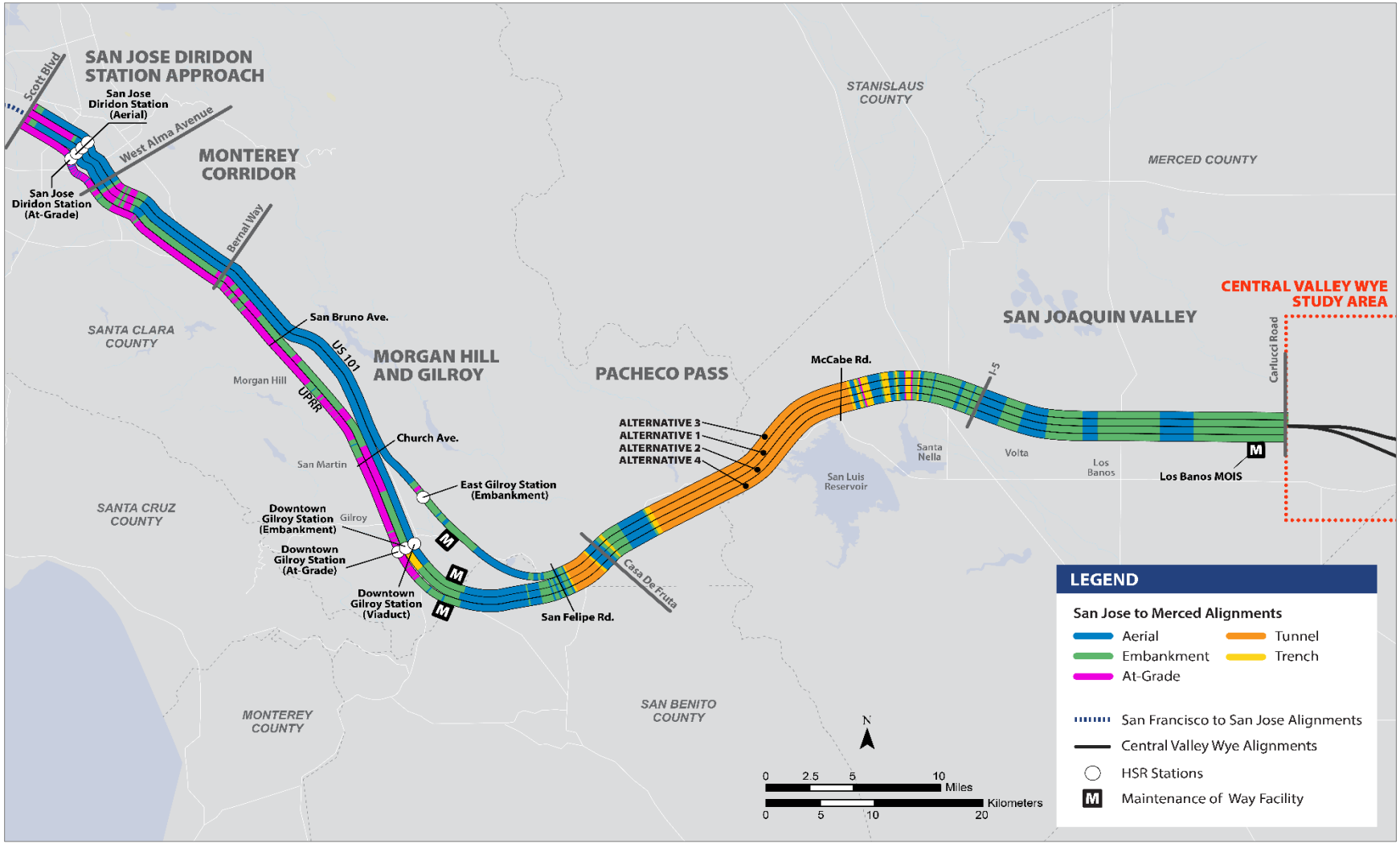
This summary presents an overview of the Final EIR/EIS, specifically presenting:

- The Final EIR/EIS as part of the tiered environmental review
- The issues raised during public outreach on the Final EIR/EIS
- The Purpose and Need for the HSR system and the Project Section
- A description of the project alternatives and the No Project Alternative

[1] The Inland Empire is a metropolitan region in Southern California encompassing most of San Bernardino and Riverside Counties. Included are the major cities of Riverside, Ontario, San Bernardino, Fontana, and Rancho Cucamonga in the eastern valleys and the high desert cities of Victorville and Hesperia in the north. The Coachella Valley, Palm Desert, and Palm Springs are to the east, and Temecula and Murrieta are to the south.

Note: HSR system described in Program EIR/EIS *MAY 2019*

Figure S-1 California High-Speed Rail Statewide System



Note: San Jose to Merced Project Alignments are described in Chapter 2, Alternatives.
Source: Authority 2019

JANUARY 2019

Figure S-2 San Jose to Merced Project Section

- The IAMFs incorporated into the design of each project alternative
- The No Project Alternative impacts
- The project alternatives evaluation, including:
  - Benefits, comparison of impacts, and mitigation measures
  - Section 4(f) and Section 6(f) property impacts
  - Environmental justice community benefits and impacts
  - Capital costs of the project alternatives
- Areas of controversy
- Environmental process, including identification of a Preferred Alternative
- Next steps in the environmental review process
- Project implementation

The full text of the environmental analysis in the Final EIR/EIS is available on the Authority's website at: http://hsr.ca.gov/Programs/Environmental_Planning/index.html.

S.1.1 Modifications Since the Draft EIR/EIS

This Final EIR/EIS is a final document that includes the text of the Draft EIR/EIS with text and figure revisions made since publication of the Draft EIR/EIS. A vertical line in the margin indicates a substantive change in the text since publication of the Draft EIR/EIS; minor editorial changes and clarifications are not identified. Key substantive changes are summarized in Section S.1.1.1, Volume 1 Summary of Key Changes, Section S.1.1.2, Volume 2 Summary of Key Changes, and Section S.1.1.3, Volume 3 Summary of Key Changes. In addition, substantive changes are summarized at the beginning of each chapter and resource topic section of Chapter 3, Affected Environment, Environmental Consequences, and Mitigation Measures.

Section 3.20, Design Variants to Optimize Speed, of the Draft EIR/EIS, has been removed from the Final EIR/EIS, and the content has been incorporated into each resource topic. The following resource topics are areas with no impact differences as a result of the inclusion of the design variants: Section 3.5, Electromagnetic Fields and Electromagnetic Interference; Section 3.6, Public Utilities and Energy; Section 3.8, Hydrology and Water Resources; Section 3.9, Geology, Soils, Seismicity, and Paleontological Resources; Section 3.10, Hazardous Materials and Waste; Section 3.11, Safety and Security; Section 3.13, Station Planning, Land Use, and Development; Section 3.14, Agricultural Farmland; Section 3.15, Parks, Recreation, and Open Space; Section 3.16, Aesthetics and Visual Quality; Section 3.17, Cultural Resources; and Chapter 4, Section 4(f)/6(f) Evaluation.

Since the close of the public comment period on the Draft EIR/EIS on June 8, 2020, and the close of the public comment period on the Revised/Supplemental Draft EIR/EIS on June 9, 2021, the Authority has reviewed the public comments and made changes between the Draft EIR/EIS and this Final EIR/EIS based on comments received. The Authority has continued to consult with local jurisdictions and property owners along the alignment and has continued to work closely with regulatory agencies with jurisdiction over some components of the project. This consultation has resulted in project refinements, updates to the impacts analysis, and additional or revised mitigation measures. This section summarizes some of the key substantive changes within the chapters and sections in Volume 1, Report; Volume 2, Technical Appendices; and Volume 3, Preliminary Engineering for Project Design Record. Each resource section in Volume 1 has been modified to reflect the changes in Volume 3, as applicable. In addition, substantive changes are summarized at the beginning of each chapter and resource topic section of Chapter 3.

The following resource topics did not have major substantive changes since publication of the Draft EIR/EIS: Section 3.9; Section 3.10; Section 3.18, Regional Growth; Chapter 6, Project Costs and Operations; Chapter 11, List of Preparers; Chapter 13, Glossary of Terms; and Chapter 14, Index. Throughout the Final EIR/EIS, the IAMF and mitigation measure language has been modified to use the term "will" instead of the term "would."

S.1.1.1 Volume 1 Summary of Key Changes

Key changes by chapter and section are summarized below. This is not a comprehensive list of changes. A more detailed list of changes is provided at the front of each chapter or section.

Chapter 1, Project Purpose, Need, and Objectives

- Section 1.1.3.2, Business Plans for the Statewide High-Speed Rail System, was updated to reference ridership forecasts for 2040 in the 2020 Business Plan (Authority 2021).
- Additional information was added about the Peninsula Corridor Joint Powers Board (PCJPB) and agreements the Authority has with PCJPB regarding blended service.

Chapter 2, Alternatives

- Updates were made to add clarifying information regarding lighting and glare associated with HSR system infrastructure.
- Revisions were made to update information regarding stations, parking, and planned land use associated with the Google Downtown West Mixed-Use Plan proposed development (Google Project) and to update the status of other projects.
- Additional information was added about the PCJPB and agreements the Authority has with PCJPB regarding blended service.
- Text was added regarding the Authority's approach to station parking facilities and clarifications of the locations of relocated parking.
- Updates were made to the table of potential permits or approvals required for the project.

Section 3.1, Introduction

- A footnote was added to address the updated CEQ regulations issued after release of the Draft EIR/EIS.
- Text was updated to reference the 2020 Business Plan (Authority 2021).

Section 3.2, Transportation

- Text was added regarding the Authority's approach to station parking facilities.
- Revisions were made to update information regarding stations and parking, including reference to the updated cumulative analysis of parking relative to the Google Project.
- Revisions were made to clarify trip generation methodology.
- Updates were made to reflect recent freight operation projections from the 2018 California State Rail Plan and to update the status and schedule for planned projects. The analysis of construction and operational effects on freight services and facilities was expanded, clarified, and updated.
- Section 3.2.7, Mitigation Measures, was modified to include site-specific traffic mitigation measures for consideration under TR-MM#1 and an analysis of the potential for secondary effects due to these site-specific mitigation measures, to include provisions under TR-MM#2 that apply during construction, and to include additional detail for TR-MM#3 concerning minimizing effects on passenger and freight rail during construction.

Section 3.3, Air Quality and Greenhouse Gases

- Clarifications regarding methodology and assumptions for the air quality analysis were provided.
- Emissions generated by light-duty gasoline-powered vehicles used during construction were remodeled to include the effects of the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule. The revised emissions results are presented in this Final EIR/EIS.

- The analysis now uses a lower *de minimis* threshold (i.e., 70 tons per year rather than 100 tons per year) for particulate matter smaller than or equal to 2.5 microns in diameter ($PM_{2.5}$) and sulfur dioxide (SO_2) in the San Joaquin Valley Air Basin.
- Refinements were made to the particulate matter mass emissions inventory to more comprehensively capture emissions reductions that would be achieved through implementation of AQ-IAMF#1: Fugitive Dust Emissions.
- Draft EIR/EIS Mitigation Measure AQ-MM#2 was deleted due to the impact of the refinements to the particulate matter emissions inventory. With these refinements, none of the project alternatives would exceed Monterey Bay Air Resources District's coarse particulate matter (PM_{10}) threshold.
- Two new air quality mitigation measures were added: AQ-MM#1: Implement Additional On-Site Emissions Controls to Reduce Fugitive Dust and AQ-MM#2: Construction Emissions Reductions – Requirements for use of Zero Emission (ZE) and/or Near Zero Emission (NZE) Vehicles and off-road equipment.

Section 3.4, Noise and Vibration

- Revisions to the operational noise impact analysis were made to reflect responses to comments received on the Draft EIR/EIS and to incorporate the updated design for the DDV and TDV.
- NV-MM#3 was modified to acknowledge that transparent materials will not be used in noise barriers in certain areas.
- NV-MM#4 was modified to include language that the Authority will assist with the preparation of technical analysis and provide input for Quiet Zone applications, which the local communities could then use as part of their application to the Federal Railroad Administration (FRA).
- The impact analysis was revised to include mitigation proposed in BIO-MM#80, which reduces the impacts at several locations in Pacheco Pass and San Joaquin Valley Subsections.
- Further analysis of the effectiveness of operational noise and vibration mitigation was added.

Section 3.5, Electromagnetic Fields and Electromagnetic Interference

- Text was added to describe magnetic field strengths in the resource study area (RSA) and to clarify that higher speeds associated with the design variants would lead to slightly higher electromagnetic field (EMF) strength but no change in impacts.

Section 3.6, Public Utilities and Energy

- Revisions were made to the impact analysis to update the existing major utilities and the number of utility conflicts, to clarify the extent of new utility infrastructure that would be required to support the project, and to reflect updated calculations of energy consumption associated with project construction.

Section 3.7, Biological and Aquatic Resources

- Revisions were made to update the federal Clean Water Act (CWA) definition of waters of the U.S. (refer to the Clean Water Act Section 404 (Waters of the U.S., including Wetlands) subsection) and to clarify that all aquatic resources in the Project Section are considered to be under federal and state jurisdiction and that the Authority would be required to obtain a Section 401 permit (refer to the Porter-Cologne Water Quality Control Act (Waters of the State) subsection).
- Updates to Section 3.7.4, Consultation with Regulatory Agencies for Federal Endangered Species Act Compliance, were made to reflect current status of consultation.

- Revisions to the impact analysis were made to reflect updated aquatic resource land cover data and species habitat models as a result of additional coordination with the U.S. Army Corps of Engineers (USACE) in spring 2021 and comments received from the U.S. Fish and Wildlife Service and National Marine Fisheries Service on the biological assessment.
- Revisions were made to the impact analysis to reflect incorporation of the Revised/Supplemental Draft EIR/EIS, to address impacts on potentially suitable breeding and rearing habitat and nectaring and dispersal habitat for listed butterflies, and to incorporate additional information and assessment regarding operational noise and lighting impacts on wildlife.
- Updates were made to add clarifying information regarding lighting and glare associated with HSR system infrastructure.
- Clarifications and additions regarding design, monitoring, and adaptive management of wildlife crossings were added. The CEQA Conclusion subsection was updated to provide further explanation of the significance conclusion.
- The following measures in Section 3.7.9, Mitigation Measures, were modified: BIO-MM#1, BIO-MM#3, BIO-MM#7, BIO-MM#8, BIO-MM#9, BIO-MM#10, BIO-MM#14, BIO-MM#23, BIO-MM#26, BIO-MM#27c, BIO-MM#28, BIO-MM#34, BIO-MM#40, BIO-MM#43, BIO-MM#51, BIO-MM#52, BIO-MM#55, BIO-MM#58, BIO-MM#60, BIO-MM#62, BIO-MM#63, BIO-MM#66, BIO-MM#68, BIO-MM#69, BIO-MM#70, BIO-MM#72, BIO-MM#75, BIO-MM#76a, BIO-MM#77a, BIO-MM#78, BIO-MM#79a, BIO-MM#80, BIO-MM#81, BIO-MM#84b, and BIO-MM#85.
- The following measures in Section 3.7.9 were added to the Final EIR/EIS: BIO-MM#P1, BIO-MM#27a, BIO-MM#27b, BIO-MM#76b, BIO-MM#77b, BIO-MM#79b, BIO-MM#84a, BIO-MM#86, BIO-MM#87, BIO-MM#88, and BIO-MM#89.
- Revisions were made to incorporate changes included in the Revised/Supplemental Draft EIR/EIS and in response to public comments on the Revised/Supplemental Draft EIR/EIS.
- Revised/Supplemental Draft EIR/EIS Appendix 3.7-D, Supplemental Species Habitat Model Descriptions; Appendix 3.7-E, Supplemental Noise Analysis on Terrestrial Wildlife Species; and Appendix 3.7-F, Supplemental Artificial Light Analysis on Terrestrial Wildlife Species (located in Volume 2), were added to the Final EIR/EIS.

Section 3.8, Hydrology and Water Resources

- Various updates and clarifications were made to the regulatory setting and the affected environment sections.
- Revisions were made to the impact analysis to account for the latest basin boundary modification approved by the California Department of Water Resources, to indicate the percentage of impervious areas the project would introduce within each watershed, and to add information regarding waterproofing of subsurface structures and the effect of subsurface structure on groundwater levels.
- The Authority performed additional hydraulic analysis for downstream areas that are outside of the RSA as part of responding to public comments, and this analysis indicated there would be negligible impacts on downstream floodplains and floodways as a result of the minimal increase in peak flow rates under Alternative 4. The impact analysis was revised to include this information. Table 3.8-31 was added to quantify existing and proposed peak 100-year flows of the Soap Lake floodplain.
- HYD-MM#3 was removed from the section because the proposed mitigation to avoid an increase in surface elevation has been incorporated into the project design.

Section 3.11, Safety and Security

- Additional information was added to the affected environment section on current safety features at existing at-grade crossings, to clarify federal requirements governing airport obstructions and state requirements governing airport-compatible land use planning, and to update the number of high-risk utilities in the RSA.
- Text was updated throughout the section to address comments on Federal Aviation Regulation 14 C.F.R. Part 77.
- The impact analysis was modified to add additional description and analysis concerning at-grade crossing safety and to identify the pedestrian-only at-grade crossing at the College Park Caltrain Station.
- Section 3.11.7, Mitigation Measures, was updated as follows:
  - Mitigation Measure SS-MM#1 was modified to include local relocation of the fire department, if necessary, to reduce project effects on response times to less than the significance threshold.
  - Mitigation Measure SS-MM#3 was updated to acknowledge the City of San Jose's implementation of Emergency Vehicle Pre-Emption and its applicability to the project.
  - Mitigation Measure SS-MM#4 was revised to modify the monitoring requirements, to clarify the provision of additional emergency response equipment for existing fire stations, and to clarify consultation with local cities and fire departments. This measure was also modified to allow for the provision of funding for initial operating costs of a new fire station in South San Jose, one in south Morgan Hill/San Martin, and one in Gilroy, if needed. This measure now also includes partnership with local emergency providers between south San Jose and Gilroy to provide real-time data on train movement and at-grade crossing gate status to help with emergency response planning.
  - Description of certain site-specific traffic mitigation measures that would apply to Alternative 4 if Mitigation Measure SS-MM#4 cannot reduce emergency vehicle response time impacts to a less-than-significant level was added.

Section 3.12, Socioeconomics and Communities

- The impact analysis was modified to provide additional information about private hunting areas, impacts in the Grasslands Ecological Area, noise and vibration impacts, displacements of commercial and industrial facilities, employment numbers, and remnant parcels.
- Section 3.12.7, Mitigation Measures, was updated to include SO-MM#1, which would be implemented to reduce impacts associated with residential displacement in certain areas.

Section 3.13, Station Planning, Land Use, and Development

- Additional information and clarifications were added to the regulatory setting and affected environment sections.
- Revisions were made to update information regarding planned land use associated with the Google Project.
- Reference to Mitigation Measure LU-MM#1 was removed, as this mitigation measure was already included as an IAMF.
- The impact analysis was modified to address intermittent noise.

Section 3.14, Agricultural Farmland

- Changes were made throughout the section to include Important Farmland under conservation easements.

- The description of how the project alternatives would be inconsistent with plans and laws were updated to reflect inconsistencies with the Santa Clara Valley Agricultural Plan, Santa Clara Valley GreenPrint, and Pajaro River Watershed Integrated Regional Water Management Plan.
- New text describing the agricultural conservation easements that intersect the RSA was added.
- Clarifications were provided regarding certain agricultural farmland impacts.
- Discussions of secondary impacts as a result of implementing each mitigation measure were added to the discussion of each mitigation measure.

Section 3.15, Parks, Recreation, and Open Space

- This section was modified to include six additional resources—Reed and Grant Streets Sports Park, Del Monte Park, Roberto Antonio Balermino Park, Elaine Richardson Park, Juan Bautista de Anza National Historic Trail, and Railroad Park.
- The impact analysis was updated to reflect the current status of planned parks, correct or update the impacts of the alternatives on certain parks, and update tables and figures throughout this section to include the appropriate resources.
- PR-MM#8 was added to the Final EIR/EIS.

Section 3.16, Aesthetics and Visual Quality

- Mitigation measure AVQ-MM#7 was updated to clarify that transparent materials will not be used in noise barriers located in Audubon Important Bird Areas or where noise barriers are being used to attenuate bird startle effects.

Section 3.17, Cultural Resources

- Additional detail was included for the description of known archaeological resources.
- Text was updated to reflect State Historic Preservation Officer (SHPO) concurrence dates for Section 106 technical reports.
- Text was modified to reflect that the Tamien Nation has elected to be a consulting party for the project.
- The impact analysis was revised to further describe the vibration impact thresholds used.
- Text was added to more clearly describe the implementation of CUL-MM#1 and CUL-MM#2.

Section 3.19, Cumulative Impacts

- Revisions were made throughout the section to update the status of cumulative projects and to reflect updates to the impact analysis for various resource topics, including transportation, air quality and greenhouse gas emissions, noise and vibration, public utilities and energy, conservation areas, hydrology and water resources, biological and aquatic resources, socioeconomics and communities, and aesthetics and visual quality.

Chapter 4, Section 4(f)/6(f) Evaluation

- The Authority's Section 4(f) determinations concerning the use of Section 4(f) protected properties were finalized and updated regarding coordination and concurrence with officials with jurisdiction over the Section 4(f) resources.
- This chapter was updated to reflect the current status of and correct name of parks, correct or update the impacts of the alternatives on certain resources, and update tables and figures throughout this section to include the appropriate resources.
- The analysis was revised to include six additional parks.

- The use determinations were updated to reflect changes in the analysis.
- The alternative with the least overall harm was identified concerning the use of Section 4(f)-protected properties.

Chapter 5, Environmental Justice

- Revisions were made to reflect updates to the impact analysis for various resource topics, including safety and security; residential and commercial displacements; station planning, land use, and development; parks and recreation; transportation; socioeconomics; air quality; noise and vibration, and cumulative effects.
- Text was added about the Authority's policies providing targeted job training and hiring opportunities for minority populations and low-income populations.
- The analysis was updated with a more detailed consideration of the offsetting value of project benefits.
- Further geographic-specific identification of effects was provided.
- Outreach efforts since the Draft EIR/EIS were added.
- Proposed offsetting mitigation measures were identified based on feedback gathered from outreach efforts and Authority policy.
- Final determinations were made concerning environmental justice effects for each of the project alternatives.

Chapter 6, Project Costs and Operations

- Revisions were made to update the capital costs to reflect design changes and escalated costs to 2021 dollars.

Chapter 7, Other CEQA/NEPA Considerations

- Revisions were made to reflect updates to the impact analysis for various resource topics.

Chapter 8, Preferred Alternative

- Updates were made to summarize comments received on the Draft EIR/EIS and Revised/Supplemental Draft EIR/EIS, to reflect revisions to the impact analysis since publication of the Draft EIR/EIS, and to clarify information about the Authority's Preferred Alternative.

Chapter 9, Public and Agency Involvement

- This chapter was updated to include the circulation of the Draft EIR/EIS and the Revised/Supplemental Draft EIR/EIS and describe the release of the Final EIR/EIS, including any additional public and agency meetings that have occurred.

Chapter 10, Distribution List

- This chapter was updated to reflect notice and distribution of the Final EIR/EIS.

Chapter 12, References

- The reference lists for each chapter and section were updated to reflect references cited in the Final EIR/EIS.

Chapter 15, Acronyms and Abbreviations

- Revisions to acronyms and additional acronyms introduced since publication of the Draft EIR/EIS were added to this section.

S.1.1.2 Volume 2 Summary of Key Changes

Key changes to appendices are summarized below. This is not a comprehensive list of changes. A more detailed list of changes is provided at the front of each appendix.

Appendix 2-E, Project Impact Avoidance and Minimization Features—This appendix was updated to reflect revisions to AQ-IAMF#4, AQ-IAMF#5, and BIO-IAMF#12.

Appendix 2-J, Regional and Local Plans and Policies—Updated to include *Envision: San José 2040 General Plan* (City of San Jose 2011), the *Santa Clara Valley Agricultural Plan* (County of Santa Clara and Santa Clara Valley Open Space Authority 2018), *Santa Clara Valley GreenPrint* (Santa Clara Valley Open Space Authority 2014), and *Pajaro River Watershed Integrated Regional Water Management Plan* (Pajaro River Watershed Regional Water Management Group 2014).

Appendix 2-K, Policy Consistency Analysis—Updated to include *Communications Hill Specific Plan Area Development Policy* (City of San Jose 2014), *Santa Clara Valley Agricultural Plan* (County of Santa Clara and Santa Clara Valley Open Space Authority 2018), and *Envision: San José 2040 General Plan* (City of San Jose 2011), and other changes.

Appendix 2-M, Gilroy LMF Option Consideration and Elimination— A new appendix was added to provide a history of planning for the Light Maintenance Facility and the reasons for eliminating a Gilroy Light Maintenance Facility from consideration.

Appendix 3.2-A, Transportation Data on Roadways, Freeways, and Intersections—This appendix was updated to reflect the results of additional analysis, including the effect of potential site-specific traffic mitigation measures under consideration.

Appendix 3.2-C, Traffic Mitigation Measures Screening— A new appendix was added to provide the screening evaluation of potential site-specific traffic mitigation measures considered to address NEPA adverse effects related to traffic against Authority criteria for identifying traffic mitigation measures.

Appendix 3.3-A, Air Quality and Greenhouse Gases Technical Report—Emissions generated by light-duty gasoline-powered vehicles used during construction were remodeled to include the effects of the SAFE Vehicles Rule. The analysis now uses a lower *de minimis* threshold. Refinements were made to the particulate matter mass emissions inventory. One mitigation measure was removed, and two new mitigation measures were added.

Appendix 3.3-B, Draft Federal General Conformity Determination—This appendix was updated to reflect the published Draft Federal General Conformity Determination.

Appendix 3.4-A, Noise and Vibration Technical Report—This appendix was updated to include analysis about the DDV and TDV.

Appendix 3.4-C, Noise Impact Locations—A new appendix was added to provide more detailed figures showing potential impact locations and noise barriers.

Appendix 3.6-A, Public Utilities and Energy Facilities—This appendix was updated to reflect missing major utility lines within the public utilities RSA.

Appendix 3.7-A, Special-Status Species Subject to Project Impacts—This appendix was updated to reflect information from the Revised/Supplemental Draft EIR/EIS regarding the California Fish and Game Commission's designation of the southern California/Central Coast population of mountain lion under the California Endangered Species Act and the monarch butterfly's status as a candidate for listing under the federal Endangered Species Act.

Appendix 3.11-B, Airport Obstructions—Text was updated throughout this appendix to address comments on Federal Aviation Regulation 14 C.F.R. Part 77.

Appendix 3.17-B, Cultural Resources - San Jose to Merced Project Section Tribal Outreach and Consultation Efforts 2009–2021—Text was added to reflect the addition of the Tamien Nation as a Section 106 consulting party.

Appendix 3.19-A, Cumulative Nontransportation Plans and Projects List—The status of cumulative nontransportation plans and projects was updated.

Appendix 3.19-B, Cumulative Transportation Plans and Projects List—The status of cumulative transportation plans and projects was updated.

Appendix 4-A, Concurrence Letter—This appendix was renamed and updated to include the concurrence letter from the City of San Jose Department of Parks, Recreation & Neighborhood Services.

Appendix 5-B, Environmental Justice Engagement Summary Report—This appendix was updated to reflect the continued outreach efforts after the release of the Draft EIR/EIS as well as ongoing environmental justice engagement activities.

Appendix 5-B, Environmental Justice Engagement Summary Report: Attachment B, List of Outreach Meetings Held for the Project—This attachment was updated to include information on engagement concerning community improvements and other engagement following the public circulation of the Draft EIR/EIS.

Appendix 5-B, Environmental Justice Engagement Summary Report: Attachment C, Biannual Environmental Justice Outreach Reports—Biannual environmental justice outreach reports were added for November 1, 2019, through April 20, 2021.

Appendix 5-B, Environmental Justice Engagement Summary Report: Attachment D, Summary of Environmental Justice Outreach in September 2021—Summary of environmental justice outreach concerning updated environmental justice analysis and community improvements in September 2021 was added.

Appendix 5-C, Environmental Justice Development of Community Improvements as Offsetting Mitigation—Description of the community improvements planning and evaluation process was added.

Appendix 5-D, Preferred Alternative, Maps of Disproportionately High and Adverse Effects Before Consideration of Offsetting Mitigation—Figures showing the location of disproportionately high and adverse effects after application of direct mitigation and consideration of the offsetting value of project benefits, but before consideration of offsetting mitigation measures, were added.

Appendix 6-A, PEPD Record Set Capital Cost Estimate Report—Capital costs were updated in this new report to reflect design changes and escalated costs to 2021 dollars.

Appendix 9-A, Public and Agency Meeting List—The list of meetings was updated to include additional public and agency meetings that have occurred.

S.1.1.3 Volume 3 Summary of Key Changes

Key changes in Volume 3 are summarized below. This is not a comprehensive list of changes. Please refer to Volume 3 for all changes.

- Drawings for the DDV to increase speeds through the San Jose Diridon Station from 15 mph to 40 mph under Alternative 4 were incorporated.
- The TDV was added to increase speeds from 200 mph to 220 mph from the maintenance of way facility (MOWF) through the Pacheco tunnels for all alternatives.
- The length of the Guadalupe River Bridge under Alternative 4 was increased to accommodate future flood control channel widening by others and avoid a potential increase in water surface elevation.
- Minor changes were incorporated to reduce conflicts in response to comments on the Draft EIR/EIS.

S.2 Tiered Environmental Review: Final Statewide Program EIR/EIS and San Jose to Merced Project Section EIR/EIS

The CEQ regulations establish procedures for compliance with the NEPA (42 United States Code [U.S.C.] § 4321 et seq.). The CEQ regulations allow a phased process, known as *tiering.* This phased decision-making process supports a broad-level programmatic decision using a first-tier EIS. This first-tier process is followed by more specific decisions at the second tier, with one or more second-tier EISs. The NEPA tiering process allows incremental decision-making for large projects that would be too extensive and cumbersome to analyze in one traditional project EIS. The CEQA (Public Resources Code § 21000 et seq.) also encourages tiering and provides for first-tier and second-tier EIRs.

Sequence of California HSR Tiered Environmental Documents

Tier 1/Program Documents

- Final Program EIR/EIS for the Proposed California High-Speed Train System (2005)
- San Francisco Bay Area to Central Valley High-Speed Train Final Program EIR/EIS (2008)
- Bay Area to Central Valley High-Speed Train Partially Revised Final Program EIR (2012)

Tier 2/Project Documents

- Merced to Fresno Section Final EIR/EIS (2012)
- Merced to Fresno Section: Central Valley Wye Final Supplemental EIR/EIS (2020)
- San Francisco to San Jose Section Draft EIR/EIS (2019)
- San Jose to Merced Section Final EIR/EIS (this document)

The San Jose to Merced Project Section EIR/EIS is a second-tier EIR/EIS that tiers off of first-tier program EIR/EIS documents and provides project-level information for decision-making on this portion of the HSR system. The Authority and the FRA prepared the 2005 *Final Program EIR/EIS for the Proposed California High-Speed Train System* (Authority and FRA 2005), which provided a first-tier analysis of the general effects of implementing the HSR system across two-thirds of the state. The 2008 *Bay Area to Central Valley High-Speed Train Final Program EIR/EIS* (Authority and FRA 2008) and the Authority's 2012 *Bay Area to Central Valley High-Speed Train Partially Revised Final Program EIR* (Authority 2012) were also first-tier programmatic documents, but they focused on the Bay Area to Central Valley region. The first-tier EIR/EIS documents provided the Authority and FRA with the environmental analyses necessary to evaluate the overall HSR system and make broad decisions about general HSR alignments and station locations for further study in the second-tier EIR/EISs. Between San Jose and Merced, the corridor advanced for Tier 2 study was the Pacheco Pass via Henry Miller Road (Union Pacific Railroad [UPRR] Connection) from San Jose to the Central Valley. The station locations advanced for Tier 2 study were a downtown San Jose/Diridon Station and a downtown Gilroy/Caltrain station, with no station between Gilroy and Merced.

Electronic copies of the Tier 1 documents are available on request by calling the Authority office at 800-455-8166. The Tier 1 documents may also be reviewed at the Authority's offices during business hours at: 770 L Street, Suite 620, Sacramento, CA 95814 and 100 Paseo de San Antonio, Suite 300, San Jose, CA 95113.

The San Jose to Merced Project Section EIR/EIS analyzes the environmental impacts and benefits of implementing the HSR in the more geographically limited area between San Jose Diridon Station and Carlucci Road and is based upon more detailed project planning and engineering. The analysis therefore builds on the earlier decisions and program EIR/EISs and provides more site-specific and detailed analysis.

Tier 1 decisions established the broad framework for the HSR system that serves as the foundation for the Tier 2 environmental review of individual projects. In 2008, the Authority and FRA selected a Pacheco Pass connection, with corridors and station locations for further examination in Tier 2 environmental reviews. As a result of litigation, the Authority prepared additional programmatic environmental review for the Bay Area and the Central Valley Project Sections and again selected the Pacheco Pass connection (Authority 2012).

The Authority and FRA prepared the Tier 1 documents in coordination with the U.S. Environmental Protection Agency (USEPA) and the USACE. The USEPA and USACE concurred that the corridors selected by the Authority and FRA in Tier 1 were most likely to yield the least environmentally damaging practicable alternative under Section 404 of the CWA.

Consistent with Tier 1 decisions, the Project Section would provide HSR service from the San Jose Diridon Station to a station in downtown Merced. This Final EIR/EIS evaluates proposed alignments and stations in site-specific detail to provide a complete assessment of the direct, indirect, and cumulative impacts of the proposed project; considers public and agency participation in the screening process; and is developed in consultation with resource and regulatory agencies, including USEPA and USACE. The Authority intends each Tier 2 EIR/EIS to be sufficient to support the USACE's permit decisions, where applicable.

Cooperating Agency

Any federal agency, other than a lead agency, that has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposed project or project alternative.

Pursuant to 23 U.S.C. Section 327, under the NEPA Assignment Memorandum of Understanding (MOU) between the FRA and the State of California, effective July 23, 2019, the Authority is the federal lead agency for environmental reviews and approvals for all Authority Phase 1 and Phase 2 California HSR System projects (FRA and State of California 2019). In this role, the Authority is the project sponsor and the lead federal agency for compliance with NEPA and other federal laws, as well as the state lead agency under CEQA. The FRA has primary responsibility for developing and enforcing rail line safety regulations in accordance with 49 U.S.C. Subtitle V, Part A (49 U.S.C. § 20101 et seq.) and for performing Clean Air Act conformity determinations and other federal approvals retained by the FRA. Three cooperating agencies are included in the NEPA review process: the USACE agreed by letter, dated December April 13, 2010, to be a cooperating agency under NEPA; the U.S. Department of the Interior, Bureau of Reclamation acknowledged cooperating agency status in a memorandum of agreement with the Authority on April 30, 2013; and the Surface Transportation Board (STB), per their letter dated May 2, 2013, is also a cooperating agency under NEPA.

S.3 Issues Raised during the Scoping Process

Public scoping is an important element in the process of determining the focus and content of an EIR/EIS and provides an opportunity for public and agency involvement. Scoping helps identify the range of actions, alternatives, environmental effects, and mitigation measures to be analyzed in depth and helps focus detailed study on those issues pertinent to the final decision on the project. The Authority initiated public scoping outreach activities for Tier 2 planning for a fully grade-separated four-track system in 2009, including the development of project information materials, establishment of a project information phone line, early engagement with interested parties, and media communications.

The Authority issued an NOP (SCH No. 2009022083) on February 23, 2009, and the FRA published an NOI in the *Federal Register* on March 16, 2009, to begin the Tier 2 project-level environmental review process. The NOP and NOI stated the purpose of the project, the project limits, a description of alternatives to be considered, the need for agency input, potential environmental impacts of the project, points of contact for additional information, and the dates and locations of the scoping meetings.

The Authority held three public and agency scoping meetings for the Draft EIR/EIS between March 18 and March 26, 2009, in Merced, San Jose, and Gilroy. These scoping meetings were an important component of the scoping process for both state and federal environmental review and provided an opportunity for the public to provide input on the project and issues for consideration in the EIR/EIS.

In addition to these formal scoping meetings, public input on the scope of the environmental review was sought through other means, including presentations, briefings, and workshops. Meetings held as part of the lead agencies' outreach effort are summarized in Section 9.2, Public and Agency Scoping (2009–2010), of this EIR/EIS. The scoping comments received from the

public, agencies, and organizations are available in appendices to the *Final Scoping Report for the San Jose to Merced High-Speed Train Project-Level EIR/EIS,* which can be requested from the Authority (Authority and FRA 2009).

In 2013, the Authority shifted focus to the preparation of a project-level supplemental EIR/EIS for the Central Valley Wye. The Authority reinitiated work on the Project Section in late 2015, adopted the 2016 Business Plan, and conducted additional community outreach and engineering along the corridor. The 2016 Business Plan (Authority 2016a) described the Authority's decision to shift its early focus from the project sections in Southern California to those in Northern California, with a goal of initiating Central Valley to Silicon Valley (Valley-to-Valley) service in 2025. During the development of the Draft EIR/EIS, between 2016 and 2019, input was solicited from the public, stakeholders, and agencies about project alternatives and to consider refinements of the prior alternatives or the addition of new alternatives responsive to their concerns.

The scoping meetings and comments received on the NOI/NOP helped the lead agencies identify general environmental issues to be addressed in the EIR/EIS. The scoping process identified issues with project elements and stations, as well as community, environmental, technical/engineering, and project costs/operations concerns. The scoping period for the environmental process lasted from February 23 to May 1, 2009. A total of 168 written and verbal (i.e., provided to a court reporter at a scoping meeting) comments were received.

The *Final Scoping Report for the San Jose to Merced High-Speed Rail Project Section EIR/EIS* (Authority and FRA 2009) is available by request via the Authority's website and provides a more comprehensive discussion of the scoping comments. The issues raised in scoping comments addressed the following resource topics and other concerns:

- Project elements and stations, including grade separations, storage and maintenance facilities, train route alignment, and station concerns
- Community concerns, including environmental justice, growth and socioeconomics, and community connectivity
- Environmental topics, including:
  - Purpose and need
  - Transportation
  - Air quality
  - Noise and vibration
  - EMF and electromagnetic interference (EMI)
  - Public utilities and energy
  - Biological resources and wetlands
  - Hydrology and water resources
  - Geology, soils, and seismicity
  - Hazardous wastes, materials
  - Safety and security
  - Socioeconomics, communities, and environmental justice
  - Local growth, station planning, and land use
  - Agricultural land
  - Parks, recreation, and open space
  - Aesthetics and visual quality
  - Cultural resources
  - Cumulative impacts
  - Public and agency involvement
- Technical and engineering interests, including technology options and advancements
- Project cost, construction, and operations

Refer to Chapter 9, Public and Agency Involvement, for additional information regarding outreach, consultation, and alternatives development for the Final EIR/EIS.

S.4 Purpose of and Need for the HSR System and the San Jose to Merced Project Section

S.4.1 Purpose of the High-Speed Rail System

The purpose of the California HSR system is to provide a reliable high-speed electric-powered train system that links the major metropolitan areas of the state and delivers predictable and consistent travel times. A further objective is to provide an interface with commercial airports, mass transit, and the highway network and relieve capacity constraints of the existing transportation system as increases in intercity travel demand in California occur, in a manner sensitive to and protective of California's unique natural resources.

S.4.2 Purpose of the San Jose to Merced Project Section

The purpose of this project is to implement the San Jose to Merced Project Section of the California HSR system: to provide the public with electric-powered HSR service that provides predictable and consistent travel times between major urban centers and connectivity to airports, mass transit systems, and the highway network in the South San Francisco Bay Area and the Central Valley; and to connect the northern and southern portions of the statewide HSR system.

S.4.3 CEQA Project Objectives for the High-Speed Rail System in California and in the San Jose to Merced Project Section

The Authority's statutory mandate is to plan, build, and operate an HSR system coordinated with California's existing transportation network, particularly intercity rail and bus lines, commuter rail lines, urban rail lines, highways, and airports. As the lead agency, the Authority is preparing this Final EIR/EIS consistent with specific CEQA EIR content and processing requirements. CEQA Guidelines Section 15124 requires an EIR to include a statement of objectives that will support the underlying purpose of the project. In response to its statutory mandate and CEQA requirements, the Authority has adopted the following objectives and policies for the proposed HSR system and the Project Section:

- Provide intercity travel capacity to supplement critically overused interstate highways and commercial airports
- Meet future intercity travel demand that would be unmet by current transportation systems, and increase capacity for intercity mobility
- Maximize intermodal transportation opportunities by locating stations to connect with local transit systems, airports, and highways
- Improve the intercity travel experience for Californians by providing comfortable, safe, frequent, and reliable high-speed travel
- Provide a sustainable reduction in travel time between major urban centers
- Increase the efficiency of the intercity transportation system
- Maximize the use of existing transportation corridors and rights-of-way, to the extent feasible
- Develop a practical and economically viable transportation system that can be implemented in phases by 2040 and generate revenues in excess of operations and maintenance costs
- Provide intercity travel in a manner considerate and protective of the region's sensitive environmental resources, and reduce emissions and vehicle miles traveled (VMT) for intercity trips

S.4.4 Statewide and Regional Need for the High-Speed Rail System Statewide and in the San Jose to Merced Project Section

The approximately 145-mile-long San Jose to Merced Project Section is an essential component of the statewide HSR system. The Project Section would provide access to a new transportation mode, contribute to increased mobility throughout California, and connect the Bay Area to the rest of the statewide HSR system via three counties: Santa Clara, San Benito, and Merced. As major population and economic centers for California, the South Bay and Central Valley regions contribute significantly to the statewide need for a new intercity transportation service that would connect San Francisco with Los Angeles and the Central Valley. Figure S-1 illustrates the location of the Project Section within California and the HSR system.

The capacity of California's intercity transportation system, including the southern Bay Area and Central Valley systems, is insufficient to meet existing and future travel demand. The current and projected future congestion of the system will continue to result in deteriorating air quality, reduced reliability, and increased travel times. The current transportation system has not kept pace with the increase in population, economic activity, and tourism within the state. The interstate highway system, commercial airports, and conventional passenger rail system serving the intercity travel market are operating at or near capacity and will require large public investments for maintenance and expansion to meet existing demand and future growth over the next 25 years and beyond. Moreover, the feasibility of expanding many major highways and key airports is uncertain; some needed expansions may be impractical or may be constrained by physical, regulatory, environmental, political, and other factors.

The need for improvements to intercity travel in California, including intercity travel between the southern San Joaquin Valley, the Bay Area, Sacramento, and Southern California, relates to the following issues:

- Future growth in demand for intercity travel
- Transportation system capacity constraints that will result in increasing congestion and travel delays
- Unreliability of travel modes stemming from congestion and delays, weather conditions, accidents, and other factors that affect the quality of life and economic well-being of residents, businesses, and tourists in California
- Reduced mobility because of increasing demand on limited modal connections among the state's major airports, transit systems, and passenger railways.
- Poor and deteriorating air quality and pressure on natural resources and agricultural lands as a result of expanded highways and airports and urban development pressures
- Legislative mandates to moderate the effects of transportation on climate change, including required reductions in GHG emissions caused by vehicles powered by the combustion of carbon-based fuels.[2]

Chapter 1, Project Purpose, Need, and Objectives, in the Final EIR/EIS provides additional information about factors relevant to intercity travel between the Bay Area and Southern California, as well as Merced, Fresno, and the Sacramento Valley.

S.5 Alternatives

This section provides an overview of the project alternatives evaluated in the Final EIR/EIS. All components of the alternatives have been evaluated during an alternatives analysis screening process, which considered the effects of the alternatives on the social, natural, and built environment. As described in Section S.2, Tiered Environmental Review: Final Statewide

[2] The following legislative mandates are described in detail in Section 3.3.2, Laws, Regulations, and Orders for Air Quality and Greenhouse Gases: Assembly Bill (AB) 1493 (2002), California Executive Order (EO) S-3-05 (2005), AB 32 (2006), EO S-01-07 (2007), Senate Bill (SB) 375 (2008), SB 32 and AB 197 (2016), SB 100 (2018), and EO B-55-18 (2018).

Program EIR/EIS and San Jose to Merced Project Section EIR/EIS, the Authority and FRA relied on program EIR/EIS documents to select the alternatives for further study between the Bay Area and the Central Valley. The four project alternatives chosen for further analysis are consistent with the train technology, alignment corridor, and station locations selected by the Authority and FRA at the conclusion of the Tier 1 EIR/EIS processes for the HSR system. The four alternatives are the result of further consideration of an extensive array of potential alternatives and sub-alternatives, all with the benefit of extensive public, stakeholder, and agency input.

S.5.1 No Project Alternative

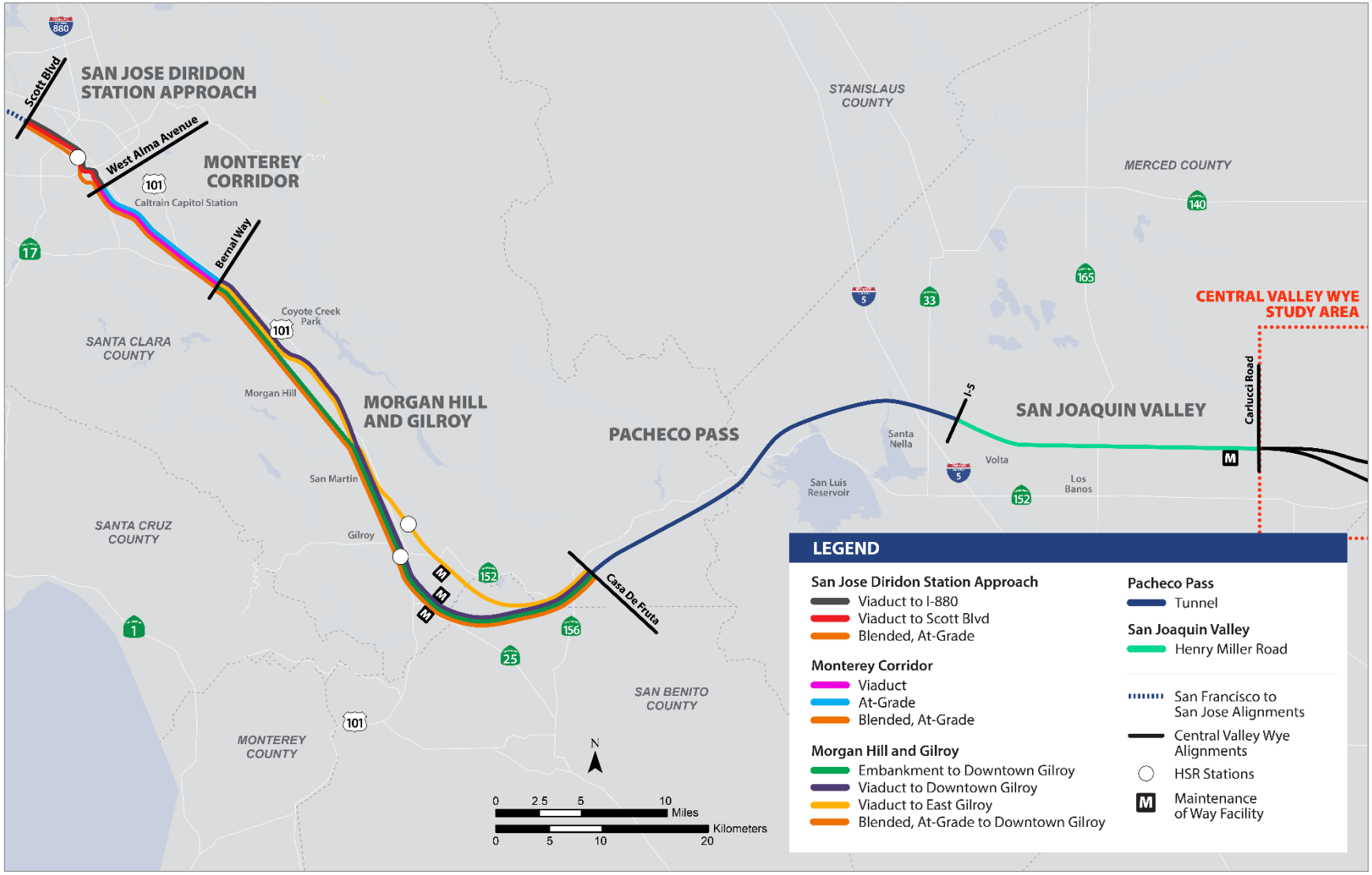
The No Project Alternative is the basis for comparison of the project alternatives. The No Project Alternative represents the state's transportation system (i.e., highway, air, bus, conventional rail) as it is currently and as it would be after implementation of programs or projects that are currently projected in regional transportation plans, which have identified funds for implementation and are expected to be in place by 2040, as well as any major planned land use changes.

NEPA requires the evaluation of a "no action" alternative in an EIS (CEQ Regulations § 1502.14(d)).[3] Similarly, CEQA requires that an EIR include the evaluation of a "no project" alternative (CEQA Guidelines § 15126.6(e)). The No Project Alternative considers the effects of current land use and transportation plans for the project area, including planned improvements to the highway, aviation, conventional passenger rail, freight rail, and port systems through the 2040 planning horizon for the environmental analysis. The No Project Alternative describes the circumstances that would exist if the lead agency were not to take the actions necessary to implement HSR service between San Jose and Merced. The No Project Alternative represents 2016 existing conditions in the Project Section RSA and future conditions in 2040, based upon projected growth, programmed and funded improvements to the intercity transportation system, and other reasonably foreseeable projects through the 2040 operational year. The No Project Alternative also considers the State Transportation Improvement Program, regional transportation plans for all modes of travel, airport plans, intercity passenger rail plans, and city and county planning documents.

S.5.2 San Jose to Merced Project Section Alternatives

The Authority has developed four end-to-end alternatives for the project: Alternative 1, Alternative 2, Alternative 3, and Alternative 4, with two design variants intended to optimize train speed. To more clearly describe the location of environmental resources and project impacts, all four alternatives are divided into five geographic subsections. Figure S-3 and Table S-1 show the design options of each alternative by subsection.

[3] The Council on Environmental Quality issued new regulations on July 14, 2020, effective September 14, 2020, updating the NEPA implementing procedures at 40 C.F.R. Parts 1500-1508. However, this project initiated NEPA before the effective date and is not subject to the new regulations, relying on the 1978 regulations as they existed prior to September 14, 2020. All subsequent citations to Council on Environmental Quality regulations in this environmental document refer to the 1978 regulations, pursuant to 40 C.F.R. 1506.13 (2020) and the preamble at 85 Fed. Reg. 43340.



Note: The design options for each subsection are described in Chapter 2, Alternatives.
Source: Authority 2019

JANUARY 2019

Figure S-3 Overview Map of Design Options by Subsection

Table S-1 San Jose to Central Valley Wye Design Options by Subsection

Subsection/Design Options	Alternative 1	Alternative 2	Alternative 3	Alternative 4
San Jose Diridon Station Approach				
Viaduct to Scott Blvd	–	X	X	–
Viaduct to I-880	X	–	–	–
Blended, At-Grade	–	–	–	X
Monterey Corridor				
Viaduct	X	–	X	–
At-Grade	–	X	–	–
Blended, At-Grade	–	–	–	X
Morgan Hill and Gilroy				
Embankment to downtown Gilroy	–	X	–	–
Viaduct to downtown Gilroy	X	–	–	–
Viaduct to east Gilroy	–	–	X	–
Blended, At-Grade to downtown Gilroy	–	–	–	X
Pacheco Pass				
Tunnel	X	X	X	X
San Joaquin Valley				
Henry Miller Rd	X	X	X	X

Source: Authority 2019
X = present; – = absent

The project is an approximately 90-mile portion of the 145-mile-long Project Section. It comprises mostly dedicated HSR system infrastructure, HSR station locations at San Jose Diridon and Gilroy, a MOWF in the Gilroy area, and a maintenance of way siding (MOWS) west of Turner Island Road in the Central Valley. HSR stations at San Jose Diridon and Gilroy would support transit-oriented development (TOD), provide an interface with regional and local mass transit services, and provide connectivity to the South Bay and Central Valley highway network.[4] The project begins at Scott Boulevard in Santa Clara. The HSR infrastructure and operations transition from the blended system between San Francisco and Santa Clara to a fully dedicated system north of the San Jose Diridon Station, either at Scott Boulevard in Santa Clara (Alternatives 2 and 3) or near Interstate (I-) 880 (Alternative 1); or, in the case of Alternative 4, the blended system extends to downtown Gilroy. The project continues south and east from Gilroy, continuing east through the Pacheco Pass to the Central

Maintenance of Way Facility (MOWF)

MOWFs provide for equipment, materials, and replacement parts storage as well as support quarters and staging areas for the HSR system subdivision maintenance personnel. Each subdivision would cover about 150 miles; the MOWF would be centrally located in the subdivision.

Maintenance of Way Siding (MOWS)

MOWSs provide temporary storage of work trains as they perform maintenance in the vicinity of the track.

Transit-Oriented Development (TOD)

Development of compact, sustainable, pedestrian-oriented communities centered around high-quality transit systems.

[4] *South Bay* refers to Santa Clara County.

Valley, to end at Carlucci Road, the western limit of the Central Valley Wye. As shown in Figure S-3, the project comprises the following five subsections:

- San Jose Diridon Station Approach—Extends approximately 6 miles from north of San Jose Diridon Station at Scott Boulevard in Santa Clara to West Alma Avenue in San Jose. This subsection includes Diridon Station.
- Monterey Corridor—Extends approximately 9 miles from West Alma Avenue to Bernal Way in the community of South San Jose. This subsection is entirely within the city of San Jose.
- Morgan Hill and Gilroy—Extends approximately 30 miles from Bernal Way in the community of South San Jose to Casa de Fruta Parkway/State Route (SR) 152 in the community of Casa de Fruta in Santa Clara County.
- Pacheco Pass—Extends approximately 25 miles from Casa de Fruta Parkway/SR 152 to east of I-5 in unincorporated Merced County.
- San Joaquin Valley—Extends approximately 20 miles from I-5 to Carlucci Road in unincorporated Merced County.

S.5.2.1 Common Design Features

Because all four alternatives follow the same general corridor, they must address many of the same concerns regarding local infrastructure. The common requirements to address these concerns are as follows:

- **Frontage road and local roadway crossings**—Where the corridor passes through rural regions, it would affect existing local frontage roads used by small communities and farm operations. Where these frontage roads parallel the HSR alignment, they would be shifted and reconstructed to maintain their functions. Where roads are perpendicular to the proposed HSR, over- or undercrossings would be planned approximately at every 2 miles. Between these crossings, some roads may be closed. A detailed list of these modifications and closures are provided in Appendix 2-A.
- **Irrigation and drainage facilities**—The project would affect existing drainage and irrigation facilities. Depending upon the severity of the impact, existing facilities would be modified, improved, or replaced as necessary to maintain existing drainage and irrigation functions, allow operations and maintenance access for facility owners, and support HSR drainage requirements.
- **Operational facilities**—HSR operational requirements include traction power distribution, ATC, communications and maintenance facilities, and underground or overhead power transmission lines. Working in coordination with power supply companies and accordance with design requirements, the Authority has identified frequency and right-of-way requirements for traction power distribution facilities.
- **State Route 87, State Route 89, State Route 101, State Route 152, Interstate-5, and Interstate-880 adjacency**—The project follows or traverses SR 87, SR 89, SR 101, SR 152, I-5, and I-880, crossing over these routes in some locations and under them in others. In some instances, the at-grade HSR guideway would cross the roadway approaches of these highway overcrossings and interchange elements. Construction of the project would entail replacement of some major state facilities, overcrossings, and interchanges to maintain horizontal and vertical clearances over the highway right-of-way or avoid traffic impacts during construction. These project components are discussed for each alternative in State Highway and Local Roadway Modifications later in this section.
- **UPRR adjacency**—The project between the Monterey Corridor and the Morgan Hill and Gilroy Subsections is designed to follow the existing UPRR corridor adjacent to the UPRR mainline right-of-way under Alternative 2, as well as some portions of it under Alternative 1. Alternative 3 is designed to further minimize interaction with the UPRR right-of-way.

Alternative 4 is designed to maximize use of existing Caltrain and UPRR rights-of-way to reduce additional right-of-way impacts.

From Tamien Station to Bloomfield Ave in Gilroy, the UPRR and proposed HSR tracks run parallel for 24.4 miles in Alternative 1, 31.4 miles in Alternative 2, and 16.4 miles in Alternative 3. Under Alternative 4, UPRR and HSR would run in parallel for 37.4 miles, from De La Cruz Boulevard to Bloomfield Avenue. In several locations, the HSR would be elevated to cross over the UPRR operational right-of-way. In these instances, the HSR would maintain required horizontal and vertical clearance over the UPRR's operational right-of-way to avoid or minimize impacts on other UPRR rights-of-way, spurs, and facilities. All alternatives, except Alternative 4, would be designed to primarily avoid the existing UPRR operations right-of-way and active rail spurs. The interaction with the UPRR right-of-way would vary by alternative as follows:

- Alternative 1 would limit longitudinal encroachments into UPRR right-of-way, but would require acquisition of 28 acres of UPRR right-of-way and another 34 acres for temporary construction.
- Alternative 2 would raise the UPRR tracks onto embankment for the southbound approach into downtown Gilroy and at the HSR station and would require 36 acres of UPRR right-of-way and 257 acres for temporary construction easements.
- Alternative 3 would entail the least amount of longitudinal encroachments or acquisition of other UPRR right-of-way for the East Gilroy Station, but would require 8 acres of UPRR right-of-way and 13 acres for temporary construction easements.
- Alternative 4 would require the most longitudinal encroachments or acquisition of UPRR right-of-way. From Communications Hill (located in the Monterey Corridor Subsection) to the MOWF south of Gilroy, HSR would install two electrified blended HSR tracks and one non-electrified freight track predominantly within existing UPRR right-of-way. The UPRR Hollister subdivision (located southeast of Gilroy) would be realigned to accommodate the MOWF and associated freight and HSR tracks. Within the UPRR right-of-way (south of Communications Hill) would be 99.8 miles of realignment.

Temporary Construction Easements—Temporary construction easements would be required along the length of the proposed alignment, ranging from isolated maximum widths of 486 feet for Alternative 1 to 568 feet for Alternative 2. Permanent right-of-way acquisitions would be required at alignment crossings.

Safety—The system safety and system security program for the development and operation of HSR is described in the Authority's Safety and Security Management Plan (SSMP), which includes the Authority's Safety and Security Policy Statement, roles and responsibilities for safety and security across the project, the program for managing safety hazards and security threats/vulnerabilities, safety and security certification program requirements, and construction safety and security requirements.

State Highway and Local Roadway Modifications

- **State highway underpasses**—Where the HSR alignment is proposed to cross over state highway facilities in various locations on aerial structures, the possibility of encroachment into the California Department of Transportation (Caltrans) right-of-way would depend upon the placement of the HSR aerial structure columns. Temporary closure of the Caltrans right-of-way may be necessary for placement of precast aerial structure sections, during which time traffic would be detoured onto local streets.
- **Roadway overcrossings**—Where the HSR alignment is at grade and runs parallel to state facilities, access would be severed where an at-grade leg of an intersection crosses the HSR alignment. Accordingly, road overcrossings would be necessary for maintaining function of the state highway and local road systems. Intersecting roads would be realigned horizontally and adjusted vertically to cross over the state highway. The possibility of encroachment into the Caltrans right-of-way would depend upon the placement of the overcrossing columns.

The design intent of these crossings is to maintain the existing intersection and traffic patterns during construction. However, when conforming to the existing roads, some short-term closures may be required, and local traffic would utilize one of the other overcrossings or intersections in the vicinity.

- **Ramp modifications**—Ramp modifications would be necessary where the HSR track is on an aerial structure, and the proposed columns directly interfere with the existing alignments of roadways or off-ramps. These ramps would be modified to avoid the proposed columns and accommodate any other roadway realignments that result from the aerial structure columns. Although the modifications would be slight, additional right-of-way may be required for the realigned off-ramps. Roadway traffic would likely use existing facilities while the realigned ramps are being constructed.

S.5.3 Station Area Development

Two stations would be constructed for the project in San Jose and Gilroy. The San Jose Diridon Station would be constructed at the existing Caltrain station. A second station—in the Morgan Hill and Gilroy Subsection—would be constructed in either downtown Gilroy or east Gilroy, depending upon the alternative selected. Conceptual station plans at both stations provide space for a multitude of services, including local and regional transit connectivity, pick-up and drop-off facilities, parking, station buildings for ticketing and support services, and passenger waiting and access area for HSR. Station planning would incorporate pedestrian and bicyclist connectivity; improved station area roadways for facilitating connectivity; expanded sidewalks, pathways, and plazas; rider pick-up and drop-off areas; and automobile parking.

S.5.4 Maintenance Facilities

Three sites for the MOWF are under consideration. The East Gilroy MOWF would be located west of the HSR mainline, south of the community of Old Gilroy, extending from north of Pacheco Pass Highway (SR 152) to north of Bloomfield Avenue. The South Gilroy MOWF would be located in one of two locations—between Carnadero Avenue and Bloomfield Avenue on the east side of the HSR alignment or south of Bloomfield Avenue on the west side of the HSR alignment.

S.6 Impact Avoidance and Minimization Features

The IAMFs are project features (such as standard engineering practices and specific training for construction workers) that have been incorporated into an alternative to avoid or minimize impacts. Table S-2 provides the available IAMFs for this project.

Table S-2 HSR Impact Avoidance and Minimization Features

Impact Avoidance and Minimization Features	
Agricultural Farmlands	
AG-IAMF#1	Restoration of Important Farmland Used for Temporary Staging Areas
AG-IAMF#2	Permit Assistance
AG-IAMF#3	Farmland Consolidation Program
AG-IAMF#4	Notification to Agricultural Property Owners
AG-IAMF#5	Temporary Livestock and Equipment Crossings
AG-IAMF#6	Equipment Crossings
Air Quality	
AQ-IAMF#1	Fugitive Dust Emissions
AQ-IAMF#2	Selection of Coatings
AQ-IAMF#3	Renewable Diesel

Impact Avoidance and Minimization Features	
AQ-IAMF#4	Reduce Criteria Exhaust Emissions from Construction Equipment
AQ-IAMF#5	Reduce Criteria Exhaust Emissions from On-Road Construction Equipment
AQ-IAMF#6	Reduce the Potential Impact of Concrete Batch Plants
Aesthetics and Visual Quality	
AVQ-IAMF#1	Aesthetic Options
AVQ-IAMF#2	Aesthetic Review Process
Biological Resources	
BIO-IAMF#1	Project Biologist
BIO-IAMF#2	Agency Access
BIO-IAMF#3	Construction Period WEAP Training
BIO-IAMF#4	Operation and Maintenance Period WEAP Training
BIO-IAMF#5	Prepare and Implement a Biological Resources Management Plan
BIO-IAMF#6	Establish Monofilament Restrictions
BIO-IAMF#7	Prevent Entrapment in Construction Materials and Excavations
BIO-IAMF#8	Delineate Equipment Staging Areas and Traffic Routes
BIO-IAMF#9	Dispose of Construction Spoils and Waste
BIO-IAMF#10	Clean Construction Equipment
BIO-IAMF#11	Maintain Construction Sites
BIO-IAMF#12	Design the Project to be Bird Safe
Cultural Resources	
CUL-IAMF#1	Geospatial Data Layer and Archaeological Sensitivity Map
CUL-IAMF#2	WEAP Training Session
CUL-IAMF#3	Pre-Construction Cultural Resource Surveys
CUL-IAMF#4	Relocation of Project Features when Possible
CUL-IAMF#5	Archaeological Monitoring Plan and Implementation
CUL-IAMF#6	Pre-Construction Conditions Assessment, Plan for Protection of Historic Built Resources, and Repair of Inadvertent Damage
CUL-IAMF#7	Built Environment Monitoring Plan
CUL-IAMF#8	Implement Protection and/or Stabilization Measures
EMF/EMI	
EMF/EMI-IAMF#1	Preventing Interference with Adjacent Railroads
EMF/EMI-IAMF#2	Controlling Electromagnetic Fields/Electromagnetic Interference
Geologic Resources	
GEO-IAMF#1	Geologic Hazards
GEO-IAMF#2	Slope Monitoring

Impact Avoidance and Minimization Features	
GEO-IAMF#3	Gas Monitoring
GEO-IAMF#4	Historic or Abandoned Mines
GEO-IAMF#5	Hazardous Minerals
GEO-IAMF#6	Ground Rupture Early Warning Systems
GEO-IAMF#7	Evaluate and Design for Large Seismic Ground Shaking
GEO-IAMF#8	Suspension of Operations during an Earthquake
GEO-IAMF#9	Subsidence Monitoring
GEO-IAMF#10	Geology and Soils
GEO-IAMF#11	Engage a Qualified Paleontological Resources Specialist
GEO-IAMF#12	Perform Final Design Review and Triggers Evaluation
GEO-IAMF#13	Prepare and Implement Paleontological Resources Monitoring and Mitigation Plan
GEO-IAMF#14	Provide WEAP Training for Paleontological Resources
GEO-IAMF#15	Halt Construction, Evaluate, and Treat if Paleontological Resources Are Found
Hazardous Materials and Wastes	
HMW-IAMF#1	Property Acquisition Phase 1 and Phase 2 Environmental Site Assessments
HMW-IAMF#2	Landfill
HMW-IAMF#3	Work Barriers
HMW-IAMF#4	Undocumented Contamination
HMW-IAMF#5	Demolition Plans
HMW-IAMF#6	Spill Prevention
HMW-IAMF#7	Transport of Materials
HMW-IAMF#8	Permit Conditions
HMW-IAMF#9	Environmental Management System
HMW-IAMF#10	Hazardous Materials Plans
Hydrology and Water Resources	
HYD-IAMF#1	Storm Water Management
HYD-IAMF#2	Flood Protection
HYD-IAMF#3	Prepare and Implement a Construction Stormwater Pollution Prevention Plan
HYD-IAMF#4	Prepare and Implement an Industrial Stormwater Pollution Prevention Plan
HYD-IAMF#5	Tunnel Design Features and Construction Methods
Station Planning, Land Use, and Development	
LU-IAMF#1	HSR Station Area Development: General Principles and Guidelines
LU-IAMF#2	Station Area Planning and Local Agency Coordination
LU-IAMF#3	Restoration of Land Used Temporarily during Construction

Impact Avoidance and Minimization Features	
Noise and Vibration	
NV-IAMF#1	Noise and Vibration
Parks, Recreation, and Open Space	
PK-IAMF#1	Parks, Recreation, and Open Space
Public Utilities and Energy	
PUE-IAMF#1	Design Measures
PUE-IAMF#2	Irrigation Facility Relocation
PUE-IAMF#3	Public Notifications
PUE-IAMF#4	Utilities and Energy
Safety and Security	
SS-IAMF#1	Construction Safety Transportation Management Plan
SS-IAMF#2	Safety and Security Management Plan
SS-IAMF#3	Hazard Analyses
SS-IAMF#4	Oil and Gas Wells
Socioeconomics and Communities	
SOCIO-IAMF#1	Construction Management Plan
SOCIO-IAMF#2	Compliance with Uniform Relocation Assistance and Real Property Acquisition Policies Act
SOCIO-IAMF#3	Relocation Mitigation Plan
Transportation	
TR-IAMF#1	Protection of Public Roadways during Construction
TR-IAMF#2	Construction Transportation Plan
TR-IAMF#3	Off-Street Parking for Construction-Related Vehicles
TR-IAMF#4	Maintenance of Pedestrian Access
TR-IAMF#5	Maintenance of Bicycle Access
TR-IAMF#6	Restriction on Construction Hours
TR-IAMF#7	Construction Truck Routes
TR-IAMF#8	Construction during Special Events
TR-IAMF#9	Protection of Freight and Passenger Rail during Construction
TR-IAMF#10	Off Peak Hour Employee Work Shift Changes at HMF
TR-IAMF#11	Maintenance of Transit Access
TR-IAMF#12	Pedestrian and Bicycle Safety

EMF = electromagnetic frequency
EMI = electromagnetic interference
HMF = heavy maintenance facility
IAMF = impact avoidance and minimization feature
WEAP = Worker Environmental Awareness Program

The Authority has committed to integrate into the project programmatic IAMFs consistent with the 2005 Statewide Program EIR/EIS (Authority and FRA 2005), the 2008 Bay Area to Central Valley Program EIR/EIS (Authority and FRA 2008) and the 2012 Partially Revised Final Program EIR (Authority 2012). Table S-2 provides the inventory of the measures that are considered to be part of all the alternatives. The full text for each IAMF is provided in Appendix 2-E, Project Impact Avoidance and Minimization Features, in Volume 2 of the Final EIR/EIS. Chapter 3 of the Final EIR/EIS provides a description of each IAMF, as well as its purpose within the context of each resource topic. The Authority would implement these features during project design and construction, as relevant to the project extent, by:

- Following existing transportation corridors to the extent feasible
- Spanning water crossings where practical
- Using shared right-of-way when feasible
- Including passages for wildlife movement
- Including narrowed footprint with elevated or retained-cut profiles
- Avoiding sensitive environmental resources to the extent practical

S.7 No Project Alternative Impacts

Projections show that under the No Project Alternative, the regional population would grow at a faster rate than the statewide average for California. General plans and other planning documents for cities and counties in the region project the locations and types of growth likely to occur under buildout of the plans. Population growth in Santa Clara, San Benito, and Merced Counties is projected to continue at an annual average growth rate of 0.8 percent, 1.6 percent, and 1.5 percent per year, respectively, with an estimated population for all three counties totaling approximately 2,804,790 people by 2040 (CDOF 2014, 2016). Housing demand in Santa Clara, San Benito, and Merced Counties is projected to increase at an annual average growth rate of 1.0 percent, 1.5 percent, and 1.1 percent, respectively, with an estimated 990,000 housing units projected in the three-county region by 2040. With population growth and increased housing demand, the employment in all three counties is also expected to increase by an annual average growth rate of 0.84 percent in Santa Clara County, 0.88 percent in San Benito County, and 0.76 percent in Merced County. Employment for all three counties is projected to reach 1,387,400 jobs by 2040. This growth will translate into continued conversion of currently undeveloped or agricultural lands to residential, small business, and light industrial uses, plus the transportation infrastructure needed to support added development. The exception would be the Pacheco Pass Subsection, which is not expected to experience urban development because of the mountainous terrain and the existing land use protections and general plan designations for the lands in the Pacheco Pass Subsection.

Intraregional long-distance travel in the San Joaquin Valley is expected to increase by 72 percent between 2010 and 2040. Daily VMT in the region could increase from approximately 12 million in 2012 to 24 million in 2040 (Authority 2016a). To accommodate this growth, transportation improvements would be completed to maintain or expand existing capacity. Planned transportation projects include highway projects such as high-occupancy vehicles and express lanes, highway widening, and new interchanges; airport improvements; passenger rail and bus projects; and freight rail improvements. Nontransportation projects primarily include land use plans, utility programs, and residential, commercial, or mixed-use development projects. A full list of anticipated future development projects is provided in Appendix 3.19-A, Cumulative Plans and Non-Transportation Projects List, and Appendix 3.19-B, Cumulative Transportation Projects Lists, in Volume 2 of this Final EIR/EIS.

Development under the No Project Alternative would result in impacts (relative to existing conditions) on the following resources:

- **Transportation**—Planned transportation development would improve network capacity but would not be enough to meet long-term future demand from population growth.

- **Noise and vibration**—Development would increase existing traffic levels and associated noise. Future freight projects would not be expected to cause higher vibration levels than the existing conditions.
- **Air quality and greenhouse gases**—Development would lead to increases in emissions of SO_2, particulate matter smaller than or equal to 10 microns in diameter (PM_{10}), and $PM_{2.5}$. These emissions are commonly generated from power plants and other industrial facilities, which are expected to increase along with population and economic growth. Total emissions for volatile organic compounds, carbon monoxide, and nitrogen oxides would decrease as a result of improvements in on-road vehicle engine technology, fuel efficiency, and turnover in older, more heavily polluting vehicles.
- **EMF and EMI**—The generation of EMF and EMI would increase in association with additional electricity use and radio frequency communications.
- **Public utilities and energy**—Growing energy demands would require additional electricity generation and transmission capacity, and greater VMT would increase petroleum demands.
- **Biological and aquatic resources**—Habitat loss and degradation and species population decline would continue or worsen from changes in land use, vehicle strikes, pollution, and noise and light.
- **Hydrology and water resources**—Development would potentially result in impacts on drainage patterns and stormwater runoff.
- **Hazardous materials and waste**—Development would continue to use or potentially disturb hazardous materials or wastes.
- **Socioeconomics and communities**—Planned projects would result in changes to the local economy and improvements to the highway, aviation, conventional passenger rail, freight rail, and port systems. Development and infrastructure projects could disrupt or divide established communities as a result of increase traffic congestion increased noise and vibration, degradation of visual quality, and increased health and safety risks.
- **Parks, recreation, and open space**—The demand for parks, recreation, and open-space resources would increase as a result of increasing population. Future park and recreational improvements and expansion would help to relieve the strain on existing facilities and minimize impacts on parks, recreational facilities, and open-space resources.
- **Aesthetics and visual quality**—Development would continue to change visual character of many locations from rural to urban.
- **Cultural resources**—Changes in land use and ground disturbance from infrastructure improvements would have the potential to disturb unknown archaeological resources and result in the demolition, destruction, relocation, or alteration of historic architectural resources or their settings. Existing land would be converted for residential, commercial, and industrial development, as well as for transportation infrastructure, to accommodate future growth, potentially disturbing archaeological sites. Planned development projects would likely include various forms of mitigation to address impacts on archaeological and built resources.
- **Geology, soils, and seismicity**—Construction and operation of infrastructure and development projects would pose risks to public safety by creating the potential for property damage caused by geologic and seismic hazards.
- **Safety and security**—The demand for law enforcement, fire, and emergency services would change and coincide with the anticipated population growth and the results of industrial, residential, and commercial development.

S.8 HSR Alternatives Evaluation

The following section provides an overview of the impacts, including benefits common to all four project alternatives. It also compares the differences in capital costs between the alternatives,

and then presents a summary of impacts that differentiates between the alternatives and proposed mitigation to avoid and reduce impacts that would occur under any of the alternatives. Table S-3 shows a detailed summary comparing construction impacts by alternative, Table S-4 shows a detailed summary comparing operations impacts by alternative, and Table S-5 shows a summary of resources subject to significant impacts under CEQA and applicable mitigation measures. Table S-6 provides a summary of the total number of significant and unavoidable impacts under CEQA for each project alternative after mitigation. (These table appear later in this Summary.)

S.8.1 HSR Benefits

The HSR system would accommodate anticipated population growth and associated travel needs by providing millions of people the option to travel by train, rather than by automobile or airline. This document utilizes ridership forecasts consistent with the Authority's 2016 Business Plan (Authority 2016a). By 2029, the initial segment of the line would carry 19.3 million passengers for medium ridership and 26 million passengers for high ridership. By 2040, these figures are expected to increase to a medium ridership of 42.8 million passengers and a high ridership of 56.8 million passengers. Projected growth rates in the three counties through which the project would travel are similar to statewide projected growth. The California Department of Finance projects the population of Santa Clara County, San Benito County, and Merced County to increase by approximately 31 percent, 49 percent, and 52 percent, respectively, by 2040 (CDOF 2014). As a result, there will be a need for additional transit to accommodate this population growth. Along with addressing the capacity constraints of automobile and airline travel, the HSR system would improve air quality, reduce congestion, and improve transportation safety and travel time.

Although the HSR project would increase electricity consumption in comparison to the No Project Alternative, the HSR project would reduce carbon emissions by providing a cleaner means of travel than automobile transportation. An HSR trip from San Francisco to Los Angeles would save 324 pounds of carbon dioxide for each car making the same trip, and a trip between San Jose and Los Angeles would save 288 pounds of carbon dioxide per car. Not only would the HSR project create fewer carbon emissions than the same trips under the No Project Alternative, but it would also be more energy efficient. An HSR trip would use one-third of the energy of a similar trip by airline travel and one-fifth of the energy used by automobile travel on a similar trip (Bay Area Council Economic Institute 2008).

The HSR system would stimulate growth and development around transit centers in central business districts, thereby creating hubs for economic investment (Bay Area Council Economic Institute 2008). HSR train stations are anticipated to become magnets for development because of the attraction they provide by access to HSR. It is also anticipated that property owners and developers could benefit from rising land values near the HSR system because of improved access by companies to their workers, to the quality of life benefits that residents perceive from access to public transit, and to retail activity stimulated by the greater flow of residents and commuters through the station (Bay Area Council Economic Institute 2008). As a result, concentrated development around multimodal centers is expected to reduce future sprawl and could reduce the likelihood of development and land use changes on the periphery of urban areas. In this way, the HSR system would seek to reduce the displacement or loss of valuable agricultural land.

Implementation of the project would result in a number of benefits to communities, members of the public, infrastructure, the environment, and the economy that would not occur under the No Project Alternative. The design of the project alternatives includes roadway improvements, such as perimeter fencing of the right-of-way, that would reduce the exposure of motorists, pedestrians, and bicyclists to traffic hazards and provide a safety benefit for children and adults. The HSR system would provide a safe and reliable means of intercity travel, operating on a partially grade-separated track and using contemporary safety, signaling, and automatic train control systems. The project alternatives, as part of the HSR system, would decrease GHG emissions, improve regional access, and result in a net savings in energy. In addition, the project alternatives would benefit the regional economy by creating jobs during construction and

generating new sales tax revenues for the region through project spending on construction, operations, and maintenance. The project alternatives would also result in local and regional benefits, including improved regional mobility, improved traffic conditions on freeways as people increasingly use HSR, improved safety, and declines in regional air quality emissions.

S.8.2 Adverse Effects Common to All Alternatives

The four end-to-end alternatives illustrated on Figure S-2 share many common elements. Because all four alternatives follow the same general corridor, they must address many of the same concerns regarding local infrastructure. As shown in Table S-1, all four alternatives are identical in the Pacheco Pass and San Joaquin Valley Subsections; Alternatives 2 and 3 use the same design options in the San Jose Diridon Station Approach Subsection; Alternatives 1 and 3 use the same design options in the Monterey Corridor Subsection; and all four alternatives use different design options in the Morgan Hill and Gilroy Subsection. Similarities in design result in common impacts among all alternatives.

Section S.8.3, Comparison of Impacts for the Project Alternatives, provides a comparative description of all impacts. As part of this comparison, Table S-3 and Table S-4 show all impacts from project construction and operations, respectively. Many of these impacts are the same across all alternatives.

S.8.3 Comparison of Impacts for the Project Alternatives

This section describes the impacts that would occur under construction and operations of each project alternative. Table S-3 and Table S-4 (provided at the end of this section) compare the construction impacts and operations impacts, respectively, between the four project alternatives, prior to mitigation. Information for resource impacts that are the same or very similar for all four project alternatives is not provided in these summary tables. For detailed discussion of the impacts of each of the project alternatives, see the resource sections in Chapter 3. Chapter 3 also includes a discussion in each resource section of impacts that would occur under each of the project alternatives in comparison to the No Project Alternative. Section S.8.6, CEQA Summary of Impacts and Mitigation, presents a summary of impact determinations under CEQA, as well as mitigation applied to avoid or reduce significant impacts under CEQA, where applicable.

Methods for NEPA and CEQA Impact Analysis

Under NEPA, impacts are described in terms of their *context* (the environment in which a proposed project impact occurs) and *intensity* (the severity of the impact). The analysis of intensity encompasses the type (direct/indirect), extent (local/regional), and duration (temporary/permanent) of the impact. NEPA's approach compares the context and intensity of impacts between alternatives under consideration.

Under CEQA, thresholds are established for each resource to determine the level of significance of impacts. If a threshold is exceeded, the impact is considered significant under CEQA.

Many regulations require standard measures to avoid and minimize environmental impacts. The Authority will comply with these regulations; therefore, they are not summarized here. Table S-5 presents all of the mitigation measures that would be applied to each project alternative to address significant impacts under CEQA. In addition, the Authority will strive to avoid and minimize impacts further as design progresses to final plans and specifications for construction. Table S-6 provides a summary of the total number of significant and unavoidable impacts under CEQA for each of the project alternatives.

Section S.8.7, Capital and Operation Costs, compares the differences in capital costs for each of the project alternatives. Section S.9, Section 4(f) and Section 6(f), describes Section 4(f) and Section 6(f) properties and any incurred uses on these properties as a result of the project alternatives. Adverse effects on and benefits to environmental justice communities as a result of the project alternatives are described in Section S.10.

S.8.3.1 Alternative 1

Alternative 1 would comprise 45.4 miles on viaduct, 21.9 miles of embankment, 2.3 miles in trench, two tunnels totaling 15.0 miles, and 4.3 miles at grade in an excavated hillside cut. Alternative 1 would begin at Scott Boulevard in blended service with Caltrain at grade. Beginning at I-880 on the southbound approach to West Hedding Street, Caltrain tracks would be realigned to accommodate the HSR tracks. Dedicated HSR tracks would diverge from the Caltrain Mainline Track (MT) 2 and MT3 tracks and continue south along the north side of the existing Caltrain corridor, crossing under West Hedding Street. To accommodate the new track configuration, the West Hedding Street roadway overpass would be replaced with a new overpass bridge and a new bridge for Stockton Avenue.

Construction of an elevated station at Gilroy would conflict with the historic Gilroy Caltrain Station and Gilroy City Hall, degrading the visual quality of the landscape unit from moderate to moderately low as viewed by viewers with moderately low sensitivity. Because it would use the highest viaduct, it would result in the greatest visual impacts of the alternatives.

Under Alternative 1, approximately 147 residential units, 217 commercial or industrial businesses, 49 agricultural properties, and 8 community and public facilities would be displaced. Temporary noise impacts at noise-sensitive locations would exceed the residential nighttime 8-hour equivalent sound level criterion of 70 A-weighted decibels and would potentially be exceeded up to 374 feet from the clear-and-grub construction activity and as far as 774 feet from the concrete pour aerial structure activity; for the PG&E upgrades, these criteria could be exceeded as far as 522 feet from the conductor installation construction activity.

Alternative 1 would have a greater potential for impacts on special-status plant species and special-status wildlife species than Alternative 4, but slightly fewer impacts than Alternatives 2 and 3. For a description of special-status species and the impacts to each species, refer to Section 3.7, Biological and Aquatic Resources.

S.8.3.2 Alternative 2

Alternative 2 would comprise 20.9 miles on viaduct, 8.5 miles at grade, 41.0 miles on embankment, two tunnels totaling 15.0 miles, and 3.2 miles in trench. There are two variations of Alternative 2, Skyway Drive Variant A and Skyway Drive Variant B. Under Skyway Drive Variant A, Monterey Road would retain its current at-grade configuration, and a new connector ramp located north corner of the intersection of Skyway Drive and Monterey Road would connect Monterey Road to the depressed Skyway Drive underpass. San Jose Fire Station #18 would have access along the connector ramp. Skyway Drive Variant B would depress Monterey Road to connect to the Skyway Drive underpass. Under this variant, access to the mobile home park north of the intersection of Skyway Drive and Monterey Road would be provided by an access road across the northern portion of the San Jose South Service Yard property. Variant B would not provide access to the fire station.

Alternative 2 would result in greater impacts from temporary road closures, realignments, and modifications than the other alternatives and greater permanent modifications resulting in an increase in travel time on major roads. Because permanent and temporary road closures would cause an increase in travel time, this alternative would result in the greatest interference with emergency response of the alternatives. Construction of Alternative 2 would result in the permanent conversion of 3,303.8 acres to a type of land use that is incompatible with the existing use, the greatest amount of all alternatives; however, the alternative would not substantially alter land use patterns, except in downtown Gilroy (similar to Alternatives 1 and 4).

Additionally, this alternative would have the greatest impacts to passenger rail operations among the alternatives. Construction of Alternative 2 would require the most utility relocations of the alternatives and also produce the greatest amount (325,000 cubic yards) of solid waste from demolition. Alternative 2 would have the potential to result in fewer impacts on paleontological resources than Alternatives 1 or 3 because it would use an embankment from Bernal Way to downtown Gilroy, which would involve substantially less excavation than a viaduct option in

Alternatives 1 and 3; however, Alternative 2 would entail more ground disturbance than Alternative 4. Construction of Alternative 2 would result in 13 completely or partially encompassed known archeological sites and would affect 11 historic built resources, the greatest of the alternatives.

Under Alternative 2, approximately 603 residential units, 348 commercial or industrial businesses, 53 agricultural properties, and 9 community and public facilities would be displaced. Temporary noise impacts at noise-sensitive locations for Alternative 2 would be similar to those under Alternative 1, with fewer noise impacts in the Morgan Hill and Gilroy and Monterey Corridor Subsections.

Alternative 2 would have greater potential for impacts on special-status plant and wildlife species than Alternatives 1 and 4, but slightly fewer impacts than Alternative 3.

S.8.3.3 Alternative 3

Alternative 3 would comprise 43.2 miles on viaduct, 1.8 miles at grade, 24.9 miles on embankment, 2.4 miles in trench, and two tunnels totaling 15.0 miles.

Construction of Alternative 3 would result in the permanent conversion of 3,084.3 acres and would introduce an incompatible land use at the station site in east Gilroy, but with the same project features as Alternative 1, it would not substantially alter land use patterns. Although this alternative would temporarily convert the most acreage of land (approximately 1,807 acres), land use patterns would not be substantially altered. Construction of Alternative 3 would result in the temporary use of 671.9 acres of Important Farmland and the permanent conversion of 1,192.5 acres of Prime Farmland, the greatest among the alternatives. For descriptions of the types of farmland and the impacts to each, refer to Section 3.14.

This alternative would result in the smallest number of utility relocations. Under Alternative 3, approximately 157 residential units, 157 commercial or industrial businesses, 49 agricultural properties, and 5 community and public facilities would be displaced. Temporary noise impacts at noise-sensitive locations for Alternative 3 would be similar to those under Alternative 1, without noise impacts on downtown Gilroy businesses.

Alternative 3 would have the greatest potential for impacts on special-status plant and wildlife species of all alternatives.

S.8.3.4 Alternative 4

Alternative 4 would comprise 15.2 miles on viaduct, 30.3 miles at grade, 25.9 miles on embankment, 2.3 miles in trench, and two tunnels totaling 15.0 miles.

Alternative 4 would have the potential to result in fewer impacts on paleontological resources than the other alternatives because it would use a blended, at-grade profile in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections, requiring substantially less excavation. Construction of this alternative would result in 90,100 cubic yards of solid waste from demolition activities, the least of all alternatives. Construction of Alternative 4 would result in the permanent conversion of 3,001.4 acres, but, with the same project features as under Alternative 1, would not substantially alter land use patterns except in downtown Gilroy. The payback period for construction energy, which would be 8.7 and 7.4 years under the medium and high ridership scenarios, respectively, would be the longest among the alternatives.

Under Alternative 4, approximately 196 residential units, 69 commercial or industrial businesses, 40 agricultural properties, and 1 community and public facility would be displaced. Temporary noise impacts at noise-sensitive locations for Alternative 4 would be similar to Alternative 1 but would be at-grade and would not include construction activities associated with a viaduct from San Jose to Gilroy.

Alternative 4 would have the least potential for impacts on special-status plant and wildlife species of all the alternatives.

S.8.3.5 Diridon and Tunnel Design Variants

The Authority has developed two design variants intended to optimize train speed. The first is located north and south of Diridon Station and at the station platforms and, if adopted, would apply only to Alternative 4, The second is located from just south of U.S. Highway 101 to the two tunnels east of Gilroy and through the Pacheco Pass and would apply, in part, to all four alternatives.

Diridon Design Variant

The DDV would allow for higher speeds in the approaches and through Diridon Station than the preliminary design for Alternative 4 would provide. The preliminary design is based on the Peninsula Corridor Electrification Project track geometry and restricts speeds approaching and through the station to 15 mph. The DDV would improve the curvature in the alignment to the north of the station between Julian Street and Santa Clara Street and from the south of the station to San Carlos Street. The design variant would also modify the preliminary design of the ends of the platforms, providing for increased speeds of 40 mph, comparable to the design speeds provided by Alternatives 1, 2 and 3.

Tunnel Design Variant

The TDV consists of alterations to all the alternatives (i.e., as compared to the base preliminary designs in Volume 3) of the tunnel and tunnel approaches in the Morgan Hill and Gilroy Subsection (Tunnel 1) and the tunnel and tunnel approaches in the Pacheco Pass Subsection (Tunnel 2) to accommodate an operating speed of 220 mph. Accordingly, the TDV consists of physical changes (described in the next paragraph) and operational changes (i.e., increased speed in the tunnels and the tunnel approaches from 200 mph to 220 mph).

The TDV would not change the horizontal alignment through the tunnels. The superelevation of tracks approaching and through both tunnels would be increased to accommodate the faster operating speeds. The TDV would flatten a set of vertical curves inside Tunnel 2. The locations of the vertical curves are near the highest subsurface location within Tunnel 2. The changes to the vertical curves would modestly increase tunnel depth compared to the Tunnel 2 design of the project alternatives without the TDV. The TDV would also require a minor increase in internal diameter of Tunnel 1 from 28 feet to 28.5 feet. Since the Tunnel 1 and Tunnel 2 location and design are equivalent across Alternatives 1 through 4, these changes could be applied to any of the alternatives.

In addition, the TDV would increase spiral lengths on two horizontal curves south of U.S. Highway 101 in the vicinity of the MOWF under Alternatives 1, 2, and 4, which would result in a minor shift in horizontal alignment (less than 2.5 feet) under those alternatives. The alignment change would not change the right-of-way as currently proposed. Alternative 3 currently meets the geometric requirements for the higher speed north of the tunnels.

The rationale for the preliminary tunnel designs of the alternatives without the TDV was to reduce the cost of the construction of the tunnels by reducing the tunnel diameter, despite the speed limitation.[5] The Authority has developed the TDV to provide design speeds of 220 mph and has identified how it can achieve speeds without increasing the bored tunnel diameter so that costs of construction are the same. The location of the TDV is identified on Figure 2-56.

[5] Per the cost reduction strategies authorized under Authority's Notice to Designers No.10 (Authority 2016b).

This Page Intentionally Left Blank

Table S-3 Comparison of Construction Impacts by Alternative

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Transportation				
Roadways, Freeways, and Intersections				
Impact TR#1: Temporary Congestion/Delay Consequences on Major Roadways, Freeways, and Intersections from Temporary Road Closures, Relocations, and Modifications	Temporary road closures and realignments would result in increases in travel times, delays, and inconvenience to the traveling public. ▪ San Jose Diridon Subsection—least impact among alternatives. ▪ Monterey Corridor Subsection—narrowing Monterey Road would affect 23 intersections. ▪ Morgan Hill and Gilroy Subsection—viaduct construction through downtown Gilroy would have fewer impacts than embankment. ▪ Pacheco Pass Subsection—impacts would be identical under all four alternatives. ▪ San Joaquin Valley—impacts would be identical under all four alternatives, closures and relocations along Henry Miller Road. The CTP would maintain traffic flow on major roadways, freeways, and intersections.	Temporary road closures and realignments would be greatest under Alternative 2. ▪ San Jose Diridon Subsection—would extend viaduct 2.4 miles farther north, affecting two additional overcrossings. ▪ Monterey Corridor Subsection—narrowing Monterey Road would affect 23 intersections. Embankment would require construction of five additional roadway overcrossings. ▪ Morgan Hill and Gilroy Subsection—greatest impact among alternatives from embankment construction through urban area. ▪ Pacheco Pass Subsection—Same as Alternative 1. ▪ San Joaquin Valley—Same as Alternative 1. The CTP would maintain traffic flow on major roadways, freeways, and intersections.	Temporary road closures and realignments would result in the least disruption of roadways under Alternative 3. ▪ San Jose Diridon Subsection—Same as Alternative 2. ▪ Monterey Corridor Subsection—narrowing Monterey Road would affect 23 intersections. ▪ Morgan Hill and Gilroy Subsection—least impact among alternatives from viaduct construction through rural area. ▪ Pacheco Pass Subsection— Same as Alternative 1. ▪ San Joaquin Valley— Same as Alternative 1. The CTP would maintain traffic flow on major roadways, freeways, and intersections.	Temporary road closures and realignments would result in increases in travel times, delays, and inconvenience to the traveling public. ▪ San Jose Diridon Subsection—similar impacts as Alternative 1. ▪ Monterey Corridor Subsection— least impact among alternatives because Monterey Road would not be narrowed. ▪ Morgan Hill and Gilroy Subsection—at-grade construction through downtown Gilroy would have fewer impacts than embankment. ▪ Pacheco Pass Subsection—impacts would be identical under all alternatives. ▪ San Joaquin Valley— Same as Alternative 1. The CTP would maintain traffic flow on major roadways, freeways, and intersections.
Impact TR#2: Temporary Congestion/Delay Consequences on Major Roadways, Freeways, and Intersections from Construction Vehicles	Project features such as the CTP and establishment of designated construction truck routes will control and manage construction vehicle traffic to minimize impacts on local vehicle circulation, delays, reductions in LOS, operations hazards, or loss of access to residences and community facilities.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact TR#3: Permanent Congestion/Delay Consequences on Roadways and Freeways from Permanent Road Closures and Relocations	18 permanent road closures and 26 permanent roadway modifications would increase vehicle traffic and degrade the LOS on US 101 in two segment locations from reduced capacity on Monterey Road.	30 permanent road closures and 45 permanent roadway modifications would increase vehicle traffic and degrade the LOS on US 101 in two segment locations from reduced capacity on Monterey Road.	17 permanent road closures and 24 permanent roadway modifications would increase vehicle traffic and degrade the LOS on US 101 in two segment locations from the reduced capacity on Monterey Road.	15 permanent road closures and 34 permanent roadway modifications would increase vehicle traffic congestion but would not degrade the LOS on US 101.
Impact TR#4: Permanent Congestion/Delay Consequences on Intersections from Permanent Road Changes	Permanent road closures and modifications would affect 14 intersections operating at LOS E or F, including 13 intersections in Monterey Corridor and 1 intersection in Morgan Hill and Gilroy in the Existing Plus Project conditions. With proposed mitigation, effects will be reduced at 4 of these intersections in Monterey Corridor and 1 intersection in Morgan Hill and Gilroy.	Permanent road closures and modifications would affect 17 intersections operating at LOS E or F, including 13 intersections in Monterey Corridor and 4 intersections in Morgan Hill and Gilroy in the Existing Plus Project conditions. With proposed mitigation, effects will be reduced at 6 intersections in Monterey Corridor and 4 intersections in Morgan Hill and Gilroy.	Same as Alternative 1	Permanent road closures and modifications would affect 2 intersections operating at LOS E or F in Morgan Hill and Gilroy in the Existing Plus Project conditions. Proposed mitigation will not reduce effects at these intersections.
Impact TR#5: Continuous Permanent Impacts on Vehicle Miles Traveled	By 2029, the project would reduce overall total VMT in Santa Clara County by 159 million miles, interregional VMT in San Benito County by 99 million miles, and interregional VMT in Merced County by 125 million miles. By 2040, the project would reduce overall total VMT in Santa Clara County by 230 million miles, interregional VMT in San Benito County by 170 million miles, and interregional VMT in Merced County by 200 million miles. If fully built out, the HSR project is forecast to reduce annual state-wide VMT by 5.7 billion in 2029 and 7.2 billion in 2040.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Parking				
Impact TR#8: Temporary Construction-Related Effects on Parking	Some public parking may require temporary closure during construction; project features will limit impacts on public parking by providing parking for construction vehicles minimizing the time parking facilities are inoperable, and providing temporary replacement of displaced special event parking for the SAP Center.	Same as Alternative 1	Same as Alternative 1 for San Jose Diridon Station and SAP Center. For East Gilroy Station, all parking demands would be met by project parking facilities.	Same as Alternative 1, except that temporary effects on parking at the San Jose Diridon Station and SAP Center would be much smaller (displacement of up to 397 parking spaces without the DDV and 432 parking spaces with the DDV vs. displacement of up to 2,083 spaces) and permanent displacement of existing spaces would be less (up to 213 spaces without the DDV and 277 spaces with the DDV vs. up to 473 spaces). Temporary displacement of special event parking during construction would be replaced on a 1:1 basis.
Transit				
Impact TR#10: Temporary Impacts on Bus Transit	For all project alternatives, construction vehicles or temporary roadway closures would result in interference with bus routes and bus stops.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact TR#11: Temporary Impacts on Passenger Rail Operations	Station construction in San Jose and Gilroy, and relocation of tracks in the San Jose Diridon Station Approach Subsection would result in temporary disruptions of Caltrain, ACE, Capitol Corridor, and Amtrak services. Alternative 1 would modify the tracks leading to the Caltrain College Park Station resulting in closure for 1 to 2 years.	Station construction in San Jose and Gilroy and relocation of tracks in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections would result in temporary disruptions of Caltrain, ACE, Capitol Corridor, and Amtrak passenger rail services. The construction of new grade separations and the temporary relocation of Caltrain stations in the Monterey Corridor and the Morgan Hill and Gilroy Subsections would also result in disruption to existing passenger rail. This alternative would have the most impacts on passenger rail operations among the alternatives.	Station construction in San Jose and relocation of tracks in the San Jose Diridon Station Approach Subsections would result in temporary disruptions of Caltrain, ACE, Capitol Corridor, and Amtrak passenger rail services. This alternative would have the least disruption of passenger rail service.	Station construction in San Jose and Gilroy and relocation of tracks in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections would result in temporary disruptions of Caltrain, ACE, Capitol Corridor, and Amtrak services. The temporary relocation and reconstruction of Caltrain stations in the Monterey Corridor and Morgan Hill and Gilroy Subsections would also result in disruption to passenger rail service. This alternative would have the second-most impacts on passenger rail operations among the alternatives.
Impact TR#12: Permanent Impacts on Bus Transit	Five high-frequency bus routes would experience delays from reduction of capacity on Monterey Road.	Same as Alternative 1	Same as Alternative 1	One high-frequency bus route would experience delays from reduction of capacity due to road closures in and near the Downtown Gilroy Station area.
Nonmotorized Travel				
Impact TR#17: Temporary Impacts on Pedestrian and Bicycle Access	Pedestrian and bicycle access would be temporarily impeded, but project features will maintain safe and adequate access.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact TR#18: Permanent Impacts on Pedestrian and Bicycle Access	Construction would require changes to pedestrian and bicycle facilities, but the project would be designed to maintain safe and accessible facilities.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Freight Rail Service				
Impact TR#20: Temporary Impacts on Freight Rail Operations	Station construction in San Jose and Gilroy and relocation of tracks in the San Jose Diridon Station Approach Subsection would result in temporary disruptions of freight rail services. Disruptions in other subsections would be limited.	Station construction in San Jose and Gilroy and relocation of tracks in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections would result in temporary disruptions of freight rail services. The construction of new grade separations in the Monterey Corridor and Morgan Hill and Gilroy Subsections would result in the disruption to existing freight rail. This alternative would have the greatest impact on freight rail of the alternatives.	Station construction in San Jose and relocation of tracks in the San Jose Diridon Station Approach Subsection would result in temporary disruptions of freight rail services. This alternative would result in the least disruption of freight rail service.	Station construction in San Jose and Gilroy and relocation of tracks in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections would result in temporary disruptions of freight rail services. The construction of relocated Caltrain stations in the Monterey Corridor and Morgan Hill and Gilroy Subsections would result in disruption to existing freight rail. This alternative would have the second-most impact on freight rail of the alternatives.

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Air Quality and Greenhouse Gases[1]				
Air Quality				
Impact AQ#1: Temporary Direct and Indirect Impacts on Air Quality within the SFBAAB	Temporary construction activity would generate NO_X emissions in excess of the General Conformity *de minimis* threshold. Maximum annual NO_X emissions of 106 tons would occur in 2024. Annual construction emissions peak in 2024 [1] due to concurrent construction of all four subsections within the SFBAAB, as well as construction of the Gilroy MOWF, San Jose Diridon Station, and Downtown Gilroy Station. Emissions of all other pollutants would be below the respective General Conformity *de minimis* thresholds.	Same as Alternative 1. Maximum annual NO_X emissions of 155 tons would occur in 2024, which is the year with the greatest amount of total construction activity in the SFBAAB.	Same as Alternative 1. Maximum annual NO_X emissions of 114 tons would occur in 2024, which is the year with the greatest amount of total construction activity in the SFBAAB.	Same as Alternative 1. Maximum annual NO_X emissions of 156 tons would occur in 2024, which is the year with the greatest amount of total construction activity in the SFBAAB.
Impact AQ#2: Temporary Direct and Indirect Impacts on Air Quality within the NCCAB	Temporary construction activity would generate criteria pollutants, but those emissions would not degrade air quality resources in the NCCAB because the RSA is considered attainment for all criteria pollutants and there are no federally regulated General Conformity *de minimis* thresholds.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact AQ#3: Temporary Direct and Indirect Impacts on Air Quality within the SJVAB	Temporary construction activity would generate NO_X emissions in excess of the General Conformity *de minimis* threshold, which could degrade air quality resources in the SJVAB. Maximum annual NO_X emissions of 56 tons would occur in 2024. Annual construction emissions peak in 2024 due to concurrent construction of the two subsections within the SJVAB, as well as construction of the Los Banos MOWS. Emissions of all other pollutants would be below the respective General Conformity *de minimis* thresholds.	Same as Alternative 1. Maximum annual NO_X emissions of 56 tons would occur in 2024, which is the year with the greatest amount of total construction activity in the SJVAB.	Same as Alternative 1. Maximum annual NO_X emissions of 56 tons would occur in 2024, which is the year with the greatest amount of total construction activity in the SJVAB.	Same as Alternative 1. Maximum annual NO_X emissions of 56 tons would occur in 2024, which is the year with the greatest amount of total construction activity in the SJVAB.
Impact AQ#4: Temporary Direct Impacts on Implementation of an Applicable Air Quality Plan	Emissions of NO_X from temporary construction activity in excess of the General Conformity *de minimis* thresholds could impede implementation of ozone plans in the SFBAAB and SJVAB.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact AQ#5: Temporary Direct Impacts on Localized Air Quality—Criteria Pollutants	Temporary construction activity would violate the 1-hour NO_2 CAAQS and NAAQS, annual PM_{10} CAAQS, annual $PM_{2.5}$ CAAQS and NAAQS, and 24-hour $PM_{2.5}$ NAAQS. Emissions concentrations would also exceed the 24-hour and annual PM_{10} SIL and 24-hour and annual $PM_{2.5}$ SIL.	Same as Alternative 1.	Temporary construction activity would violate the annual PM_{10} CAAQS, annual $PM_{2.5}$ CAAQS and NAAQS, and 24-hour $PM_{2.5}$ NAAQS. Emissions concentrations would also exceed the 24-hour and annual PM_{10} SIL and 24-hour and annual $PM_{2.5}$ SIL.	Temporary construction activity would violate the 1-hour NO_2 CAAQS and NAAQS, annual and 24-hour PM_{10} CAAQS, annual $PM_{2.5}$ CAAQS and NAAQS, and 24-hour $PM_{2.5}$ NAAQS. Emissions concentrations would also exceed the 24-hour and annual PM_{10} SIL and 24-hour and annual $PM_{2.5}$ SIL.
Impact AQ#6: Temporary Direct Impacts on Localized Air Quality—Exposure to Diesel Particulate Matter and $PM_{2.5}$ (Health Risk)	Temporary construction activity would not generate DPM or $PM_{2.5}$ concentrations in excess of established health risk thresholds. The maximum increase in potential cancer risk (5.0 per million) would occur in the San Joaquin Valley Subsection.	Same as Alternative 1. The maximum increase in potential cancer risk (5.0 per million) would occur in the Monterey Corridor and San Joaquin Valley Subsection.	Same as Alternative 1. The maximum increase in potential cancer risk (9.4 per million) would occur in the Morgan Hill and Gilroy Subsection.	Same as Alternative 1 without the DDV. The maximum increase in potential cancer risk (6.1 per million) for Alternative 4 without the DDV would occur in the Monterey Corridor Subsection. For Alternative 4 with the DDV, the incremental cancer risk would be 8.4 per million.
Impact AQ#7: Temporary Direct Impacts on Localized Air Quality—Exposure to Asbestos, Lead-Based Paint, and Fungal Spores That Cause Valley Fever	Project design and compliance with existing asbestos and LBP handling and disposal standards, as well as fugitive dust control practices, would prevent exposure of sensitive receptors to substantial pollutant concentrations. There would be limited potential for exposure of sensitive receptors to asbestos or LBP associated with demolition of 4.3 million square feet. There would be limited potential for exposure of sensitive receptors to Valley fever associated with movement of 51.5 million cubic yards of soil and disturbance of 813 acres.	Same as Alternative 1. There would be limited potential for exposure of sensitive receptors to asbestos or LBP associated with demolition of 7.1 million square feet. There would be limited potential for exposure of sensitive receptors to Valley fever associated with movement of 60.4 million cubic yards of soil and disturbance of 1,047 acres.	Same as Alternative 1. There would be limited potential for exposure of sensitive receptors to asbestos or LBP associated with demolition of 4.0 million square feet. There would be limited potential for exposure of sensitive receptors to Valley fever associated with movement of 58.7 million cubic yards of soil and disturbance of 870 acres.	Same as Alternative 1. There would be limited potential for exposure of sensitive receptors to asbestos or LBP associated with demolition of 2.0 million square feet. There would be limited potential for exposure of sensitive receptors to Valley fever associated with movement of 52.2 million cubic yards of soil and disturbance of 1,048 acres.

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact AQ#8: Temporary Direct Impacts on Localized Air Quality—Exposure to Odors	There would be limited potential for odors generated by construction to affect sensitive receptors or result in nuisance complaints.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact AQ#9: Continuous Permanent Direct Impacts on Air Quality within the SFBAAB, NCCAB, and SJVAB	Long-term operation of the HSR system would reduce regional criteria pollutant emissions, relative to No Project conditions, resulting in a regional and local air quality benefit. Annual reductions would range from 23 to 54 tons of VOC, 332 to 1,120 tons of CO, 208 to 447 tons of NO_X, 22 to 48 tons of SO_2, 25 to 69 tons of PM_{10}, and 11 to 26 tons of $PM_{2.5}$, depending on the ridership scenario.	Same as Alternative 1. Annual reductions would range from 23 to 54 tons of VOC, 332 to 1,120 tons of CO, 208 to 447 tons of NO_X, 22 to 48 tons of SO_2, 18 to 61 tons of PM_{10}, and 10 to 25 tons of $PM_{2.5}$, depending on the ridership scenario.	Same as Alternative 1. Annual reductions would range from 23 to 54 tons of VOC, 330 to 1,119 tons of CO, 208 to 447 tons of NO_X, 22 to 48 tons of SO_2, 23 to 66 tons of PM_{10}, and 10 to 26 tons of $PM_{2.5}$, depending on the ridership scenario.	Same as Alternative 1. Annual reductions would range from 23 to 54 tons of VOC, 332 to 1,120 tons of CO, 208 to 447 tons of NO_X, 22 to 48 tons of SO_2, 16 to 59 tons of PM_{10}, and 9 to 25 tons of $PM_{2.5}$, depending on the ridership scenario.
Impact AQ#10: Continuous Permanent Direct Impacts on Implementation of an Applicable Air Quality Plan	Emissions reductions from project operations would support implementation of air quality plans and attainment of regional air quality goals.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact AQ#11: Continuous Permanent Direct Impacts on Localized Air Quality—Carbon Monoxide Hot Spots (NAAQS Compliance)	Increased traffic would not result in localized CO hot spots or exceedances of the CO NAAQS or CAAQS.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact AQ#12: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Mobile Source Air Toxics	Operation of the HSR system would result in a regional MSAT reduction and benefit. Increased station traffic would have a low potential for meaningful localized MSAT impacts.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact AQ#13: Continuous Permanent Direct Impacts on Localized Air Quality—Particulate Matter Hot Spots (NAAQS Compliance)	The project is not considered to be a project of air quality concern, based on the descriptions as indicated in 40 C.F.R. Section 93.123(b)(1).	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact AQ#14: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Diesel Particulate Matter and $PM_{2.5}$ (Health Risk)	Emissions of DPM and $PM_{2.5}$ from relocated freight service and station and maintenance facility operation would not expose sensitive receptors to pollutant health risks in exceedance of BAAQMD's thresholds.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact AQ#15: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Odors	Emissions-generated odors would be limited and would not be expected to affect a substantial number of people.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Greenhouse Gases				
Impact AQ#16: Temporary Direct and Indirect Impacts on Global Climate Change—Greenhouse Gas Emissions	GHG emissions generated during temporary construction of 14,870 metric tons CO_2e per year would be offset by reductions achieved through project operations in 8 to 10 months (relative to 2029 No Project conditions).	GHG emissions generated during temporary construction of 18,635 metric tons CO_2e per year would be offset by reductions achieved through project operations in 9 to 13 months (relative to 2029 No Project conditions).	GHG emissions generated during temporary construction of 15,082 metric tons CO_2e per year would be offset by reductions achieved through project operations in 8 to 10 months (relative to 2029 No Project conditions).	GHG emissions generated during temporary construction of 20,043 metric tons CO_2e per year would be offset by reductions achieved through project operations in 10 to 14 months (relative to 2029 No Project conditions).
Impact AQ#17: Continuous Permanent Direct and Indirect Impacts on Global Climate Change—Greenhouse Gas Emissions	Long-term operation of the HSR system would reduce GHG emissions, relative to No Project conditions, resulting in a statewide and regional GHG benefit. Annual reductions would range from 1.1 million metric tons CO_2e to 1.6 million metric tons CO_2e, depending on the ridership scenario.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Noise and Vibration				
Noise				
Impact NV#1: Temporary Exposure of Sensitive Receptors to Construction Noise	Temporary noise impacts at noise sensitive locations would exceed the residential nighttime 8-hour L_{eq} criterion of 70 dBA for typical track construction activities up to 374 feet from the clear-and-grub construction activity and up to 774 feet from the concrete pour aerial structure activity. For the PG&E upgrades, these criteria would be exceeded as far away as 522 feet from reconductoring activity. These distances would be applicable to all four project alternatives.	Similar to Alternative 1, with fewer noise impacts in Morgan Hill, Gilroy and Monterey Corridor Subsections.	Similar to Alternative 1, without noise impacts on downtown Gilroy businesses.	Similar to Alternative 1, but no concrete pour aerial structure activity from San Jose to Gilroy. This would have more impacts in Morgan Hill.
Vibration				
Impact NV#9: Temporary Exposure of Sensitive Receptors and Buildings to Construction Vibration	Potential annoyance from nighttime vibratory methods within 300 feet of residential structures. Potential building damage from impact pile driving within 50 feet of structures. Potential perceptible vibration in occupied buildings within 100 feet of tunnel boring operations for tunnel construction.	Similar to Alternative 1 but potentially more vibratory compaction at embankments and at grade at the Monterey Corridor and Morgan Hill and Gilroy Subsections; less vibratory compaction in San Jose to Scott Blvd touchdown.	Similar to Alternative 1 in Gilroy and in Monterey Corridor Subsection, but eastern alignment in Gilroy and Morgan Hill would affect fewer structures; similar to Alternative 2 in the Monterey Corridor Subsection through San Jose.	Similar to Alternative 1 east of Gilroy; most vibratory compaction at embankments and at-grade portions of all project alternatives; construction in existing right-of-way would require more nighttime work to minimize service disruptions.
EMF and EMI				
Impact EMF/EMI#1: Temporary Impacts from Use of Construction Equipment	Construction activities would occur more than 50 feet from facilities with known sensitive equipment. Therefore, these facilities would not be exposed to EMF generated by construction equipment. No individuals would be exposed to EMF levels that exceed human health standards. EMF generated during construction would be below levels known to disrupt agricultural activities.	Temporary construction activity would cause fluctuations in EMF levels, although the practical effects would be limited to within 50 feet of the project footprint and would comply with FCC regulations. No individuals would be exposed to EMF levels that exceed human health standards. Construction activities would occur within 15 feet of the Butterfield Professional Center, a facility with known sensitive equipment. EMF generated during construction would be below levels known to disrupt agricultural activities.	Same as Alternative 1	Same as Alternative 1
Public Utilities and Energy				
Public Utilities				
Impact PUE#1: Planned and Accidental Temporary Interruption of Utility Service	Planned and accidental interruptions to utility services would be temporary and for short durations. There are 212 major utility lines within the RSA for Alternative 1.	Same as Alternative 1, except there are 303 major utility lines within the RSA for Alternative 2.	Same as Alternative 1, except there are 202 major utility lines within the RSA for Alternative 3.	Same as Alternative 1, except there are 404 major utility lines within the RSA for Alternative 4.
Impact PUE#2: Temporary Impacts from Water Use	Construction would require 4,339 acre-feet of water, which is 10 percent of the current water usage for the land within the project footprint.	Construction would require 4,205 acre-feet of water which is 9 percent of the current water usage for the land within the project footprint.	Construction would require 4,555 acre-feet of water, which is 10 percent of the current water usage for the land within the project footprint.	Construction would require 4,426 acre-feet of water, which is 10 percent of the current water usage for the land within the project footprint.
Impact PUE#3: Reduced Access to Existing Utilities in the HSR Right-of-Way	Access to utilities would be provided during and after construction of all project alternatives.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact PUE#4: Existing Major Utilities Requiring Relocation or Removal	Relocation of 158 major utility lines and protection in place of 46 utility lines; removal, extension, realignment/ abandonment of 8 utility lines. Displacement of 3 percolation ponds comprising 51 acres at SCRWA WWTP.	Relocation of 235 major utility lines and protection in place of 61 major utility lines; removal, extension, realignment/ abandonment of 7 utility lines. Displacement of 3 percolation ponds comprising 51 acres at SCRWA WWTP.	Relocation of 150 major utility lines and protection in place of 45 major utility lines; removal, extension, realignment/ abandonment of 7 utility lines. No impact on the SCRWA WWTP.	Relocation of 176 major utility lines and protection in place of 165 major utility lines; removal, extension, realignment/ abandonment of 17 utility lines. No impact on the SCRWA WWTP.

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact PUE#5: Temporary Impacts from Construction of New Utility Infrastructure	Alternative 1 includes the construction of three TPSSs and co-located electric utility switching stations; each TPSS site occupying up to 2 acres; TPSS Site 4 would be built at one of two alternative sites in Gilroy. Alternative 1 includes reconductoring of three 115-kV power lines; construction of new potable water and wastewater lines to stations and maintenance facilities; construction of new stormwater management infrastructure in the Morgan Hill and Gilroy Subsection. New storm drainage infrastructure would be built in the Pacheco Pass Subsection.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact PUE#6: Temporary Impacts from Stormwater and Wastewater Generation during Construction	Construction would require 4,339 acre-feet of water resulting in potential generation of 0.41 mgd of wastewater, which is less than 0.2 percent of the total wastewater treatment capacity within the RSA.	Construction would require 4,205 acre-feet of water resulting in potential generation of 0.39 mgd of wastewater, which is less than 0.2 percent of the total wastewater treatment capacity within the RSA.	Construction would require 4,555 acre-feet of water resulting in potential generation of 0.45 mgd of wastewater, which is less than 0.25 percent of the total wastewater treatment capacity within the RSA.	Construction would require 4,426 acre-feet of water resulting in potential generation of 0.40 mgd of wastewater, which is less than 0.2 percent of the total wastewater treatment capacity within the RSA
Impact PUE#7: Temporary Generation of Solid Waste and Hazardous Waste during Construction	Construction would result in 199,300 cubic yards of solid waste from demolition activities.	Construction would result in 325,000 cubic yards of solid waste from demolition activities.	Construction would result in 184,800 cubic yards of solid waste from demolition activities.	Construction would result in 90,100 cubic yards of solid waste from demolition activities.
Energy				
Impact PUE#12: Temporary Consumption of Energy during Construction	Construction would require 22,745 billion Btu.	Construction would require 28,755 billion Btu.	Construction would require 24,015 billion Btu.	Construction would require 29,290 billion Btu.
Biological and Aquatic Resources[2]				
Special-Status Species				
Impact BIO#1: Permanent Conversion or Degradation of Habitat for Special-Status Plant Species	The project would remove or disturb habitat for 54 special-status plant species, 8 of which are listed under the FESA or CESA, and could degrade habitat outside of but adjacent to the project footprint. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on special-status plants and their habitat under all alternatives.			
Habitat for all special-status plants (nonoverlapping)	1,639.4	Habitat for all special-status plants (nonoverlapping)	1,639.4	Habitat for all special-status plants (nonoverlapping)
Impact BIO#2a: Permanent Conversion or Degradation of Habitat for and Mortality of Bay Checkerspot Butterfly	The project would remove or disturb habitat (including critical habitat) for Bay checkerspot butterfly, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Increased shadows from construction of the viaduct in the Morgan Hill and Gilroy Subsection could alter flight behavior. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on Bay checkerspot butterfly under Alternative 1.	Impacts under Alternative 2 would be similar to Alternative 1 but would not have shadow impacts on flight behavior because it would be constructed on an embankment instead of viaduct. The area of affected habitat would be the same as Alternative 1.	Impacts under Alternative 3 would be similar to Alternative 1, but would affect slightly more habitat than Alternative 1.	Impacts under Alternative 4 would be similar to Alternative 1, but would affect less habitat.
Habitat for Bay checkerspot butterfly	32.4	42.5	32.4	25.4
Designated critical habitat for Bay checkerspot butterfly	26.0	34.8	26.0	21.0
Impact BIO#2b: Permanent Conversion or Degradation of Habitat for and Mortality of Monarch Butterfly	The project would disturb or convert habitat for monarch butterfly and could degrade suitable habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on monarch butterfly under Alternative 1.	Impacts under Alternative 2 would be the same as under Alternative 1.	Impacts under Alternative 3 would be the same as under Alternative 1.	Impacts under Alternative 4 would be the same as under Alternative 1.

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Habitat for monarch butterfly	5,345.8	5,606.8	5,548.8	5,092.3
Impact BIO#3: Permanent Conversion or Degradation of Habitat for and Mortality of Vernal Pool Crustaceans	The project would or disturb habitat for Conservancy fairy shrimp, longhorn fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp, and could degrade vernal pool habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on vernal pool crustaceans under all alternatives.			
Habitat for vernal pool fairy shrimp	27.6			
Habitat for vernal pool tadpole shrimp	27.6			
Habitat for longhorn fairy shrimp	27.6			
Habitat for Conservancy fairy shrimp	27.6			
Impact BIO#4: Removal or Pruning of Elderberry Plants Potentially Supporting Valley Elderberry Longhorn Beetle	The project may remove elderberry plants potentially occupied by valley elderberry longhorn beetle and could degrade habitat outside of but adjacent to the project footprint. Removal of occupied elderberry plants would result in mortality of individuals. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on valley elderberry longhorn beetle under all alternatives.			
Habitat potentially supporting valley elderberry longhorn beetle	158.9			
Impact BIO#5: Permanent Conversion or Degradation of Habitat for and Mortality of Crotch Bumble Bee	The project would convert and disturb habitat and could result in the mortality of individual bees if underground nest colonies or overwintering queens are present in the project footprint at the time of construction. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on Crotch bumble bee under all alternatives.			
Habitat potentially supporting Crotch bumble bee	1,583.6	1,616.3	1,592.8	1,539.7
Impact BIO#6: Permanent Conversion of Habitat for and Direct Mortality of Steelhead and Pacific Lamprey, and Permanent Conversion of Essential Fish Habitat for Pacific Coast Salmon	The project would remove or disturb stream habitat for CCC and SCCC steelhead, Pacific lamprey, and designated EFH for Pacific Coast (Chinook and coho) salmon, and could degrade habitat downstream of the project footprint at affected stream crossings. Pile-driving and dewatering activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on special-status fish under all alternatives.			
Habitat for CCC/SCCC steelhead	34.0	36.1	46.8	31.1
Designated freshwater EFH for Pacific Coast salmon	9.8	10.2	9.8	6.6
Habitat for Pacific lamprey	207.4	213.1	212.6	200.5
Designated critical habitat for CCC/SCCC steelhead	8.2	9.4	9.4	7.5
Impact BIO#7: Permanent Conversion or Degradation of Habitat for and Direct Mortality of California Tiger Salamander	The project would remove or disturb habitat (including critical habitat) for California tiger salamander, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction, would minimize direct and indirect impacts on California tiger salamander under all alternatives.			
Habitat for California tiger salamander	3,159.7	3,392.7	3,404.3	2,968.6
Designated critical habitat for California tiger salamander	278.5			
Impact BIO#8: Permanent Conversion or Degradation of Habitat for and Direct Mortality of California Red-Legged Frog	The project would remove or disturb habitat (including critical habitat) for California red-legged frog, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on California red-legged frog under all alternatives.			
Habitat for California red-legged frog	2,837.6	3,333.5	3,001.6	2,469.7
Designated critical habitat for California red-legged frog	923.6	923.6	923.0	923.6

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact BIO#9: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Foothill Yellow-Legged Frog	The project would remove or disturb habitat for foothill yellow-legged frog, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on foothill yellow-legged frog under all alternatives.			
Habitat for foothill yellow-legged frog	133.0	131.2	132.9	127.7
Impact BIO#10: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Western Spadefoot	The project extent would remove or disturb habitat for western spadefoot, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on western spadefoot under all alternatives.			
Habitat for western spadefoot	740.8	740.8	760.9	740.8
Impact BIO#11: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Western Pond Turtle	The project would remove or disturb habitat for western pond turtle, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on western pond turtle under all alternatives.			
Habitat for western pond turtle	3,901.0	4,388.2	3,811.5	3,517.2
Impact BIO#12: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Blunt-Nosed Leopard Lizard	The project would remove or disturb habitat for blunt-nosed leopard lizard, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on blunt-nosed leopard lizard under all alternatives.			
Habitat for blunt-nosed leopard lizard	696.3			
Impact BIO#13: Permanent Conversion or Degradation of Habitat for and Direct Mortality of San Joaquin Coachwhip, Northern California Legless Lizard, and Coast Horned Lizard	The project would remove or disturb habitat for San Joaquin coachwhip, northern California legless lizard, and coast horned lizard, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on these species under all alternatives.			
Habitat for San Joaquin coachwhip	855.9	855.9	855.8	855.9
Habitat for northern California legless lizard	19.8	19.8	19.7	19.8
Habitat for coast horned lizard	1,227.1	1,227.1	1,226.8	1,227.1
Impact BIO#14: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Giant Garter Snake	The project would remove or disturb habitat for giant garter snake, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on giant garter snake under all alternatives.			
Habitat for giant garter snake	568.0			
Impact BIO#15: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Short-Eared Owl and Grasshopper Sparrow	The project would remove or disturb habitat for short-eared owl and grasshopper sparrow, and could degrade habitat outside of but adjacent to the project footprint. Activities could also destroy or cause abandonment of active nests, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on these species under all alternatives.			
Habitat for short-eared owl	514.9			
Habitat for grasshopper sparrow	945.8	945.8	945.7	945.8
Impact BIO#16: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Mountain Plover and Western Snowy Plover (Interior Population)	The project would remove or disturb habitat for mountain plover, and could degrade habitat outside of but adjacent to the project footprint. Activities could also destroy or cause abandonment of active western snowy plover nests, if present in affected habitat, and disturb wintering mountain plovers. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on these species under all alternatives.			
Habitat for mountain plover	907.6			
Habitat for western snowy plover	35.1			

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact BIO#17: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Burrowing Owl	The project would remove or disturb habitat for burrowing owl. Activities could also result in mortality of individuals by crushing occupied burrows or collapsing burrow entrances and preventing escape. Activities could also disturb nesting pairs and cause them to abandon eggs or young. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on burrowing owl under all alternatives.			
Habitat for burrowing owl	2,176.8	2,441.1	2,366.3	2,014.6
Impact BIO#18: Permanent Conversion or Degradation of Habitat for and Disturbance of Golden Eagle and Bald Eagle	The project would remove or disturb habitat for golden eagle and bald eagle. Activities within 0.5 mile of active nests could cause nesting pairs to abandon eggs or young. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct impacts on these species under all alternatives.			
Habitat for golden eagle	1,552.5	1,581.5	1,561.8	1,505.9
Habitat for bald eagle	536.8	548.8	526.6	515.7
Impact BIO#19: Injury or Disturbance of California Condor	The project would be constructed at the edge of the California condor's range; however, individuals could fly over, forage, or land during construction activities. Construction debris and other materials could be ingested or cause entanglement. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct impacts on California condor under all alternatives.			
Impact BIO#20: Permanent Conversion or Degradation of Habitat for and Disturbance of Special-Status Raptors (American Peregrine Falcon, Northern Harrier, White-Tailed Kite) and Other Raptors	The project would remove or disturb habitat for American peregrine falcon, northern harrier, white-tailed kite, and other raptors. Activities within 500 feet of active nests could cause nesting pairs to abandon eggs or young. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct impacts on these species under all alternatives.			
Habitat for American peregrine falcon	4,594.7	5,287.7	4,682.6	4,012.5
Habitat for northern harrier	2,481.1	2,751.3	2,675.0	2,356.6
Habitat for white-tailed kite	3,218.4	3,478.5	3,412.9	2,971.9
Impact BIO#21: Permanent Conversion or Degradation of Habitat for and Disturbance of Swainson's Hawks	The project would remove or disturb habitat for Swainson's hawk. Activities within 0.5 mile of active nests could cause nesting pairs to abandon eggs or young. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct impacts on Swainson's hawk under all alternatives.			
Habitat for Swainson's hawk	1,534.4	1,743.5	1,534.4	1,480.8
Impact BIO#22: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Purple Martin, Olive-Sided Flycatcher, and Loggerhead Shrike	The project would remove or disturb habitat for purple martin, olive-sided flycatcher, and loggerhead shrike. Activities could also destroy or cause abandonment of active nests, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on these species under all alternatives.			
Habitat for loggerhead shrike	3,275.8	3,535.8	3,471.7	3,029.2
Habitat for purple martin	443.8	443.8	442.0	443.8
Habitat for olive-sided flycatcher	463.6	463.6	461.7	463.6
Impact BIO#23: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Least Bell's Vireo, Yellow Warbler, and Yellow-Breasted Chat	The project would remove or disturb habitat for least Bell's vireo, yellow warbler, and yellow-breasted chat, and could degrade habitat outside of but adjacent to the project footprint. Activities could also destroy or cause abandonment of active nests, if present in affected habitat. Construction BMPs, WEAP training, restoration and revegetation of disturbed areas, and invasive weed control measures will minimize direct and indirect impacts on these species under all alternatives.			
Habitat for least Bell's vireo	119.3	124.5	120.7	105.3
Habitat for yellow warbler	54.2	55.1	53.5	45.3
Habitat for yellow-breasted chat	47.1	47.1	46.3	44.1
Impact BIO#24: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Tricolored Blackbird and Yellow-Headed Blackbird	The project would remove or disturb habitat for tricolored blackbird and yellow-headed blackbird, and could degrade habitat outside of but adjacent to the project footprint. Activities could also destroy or cause abandonment of active nests, if present in affected habitat. Construction BMPs, pre-construction nest surveys, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on these species under all alternatives.			
Habitat for tricolored blackbird	2,630.3	2,906.9	2,836.6	2,498.2

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Habitat for yellow-headed blackbird	10.6			
Impact BIO#25: Permanent Conversion or Degradation of Habitat for and Disturbance of Sandhill Crane	The project would remove or disturb habitat for sandhill crane, and could degrade habitat outside of but adjacent to the project footprint. Activities could also disturb wintering sandhill cranes, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on sandhill crane under all alternatives.			
Habitat for greater sandhill crane	524.5			
Habitat for lesser sandhill crane	669.1			
Impact BIO#26a: Loss of Breeding, Foraging, and Dispersal Habitat for and Direct Mortality or Disturbance of Mountain Lion	The project would remove or disturb habitat for mountain lion and could degrade habitat outside of but adjacent to the project footprint. Construction activities could disrupt or prohibit the gene flow between mountain lion subpopulations. Activities could also result in mortality of individuals by crushing occupied dens and preventing escape. Activities could also disturb individuals and impair breeding, feeding, or sheltering behavior. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on mountain lion under all alternatives.			
Habitat for mountain lion	3,713.9	4,007.5	3,913.0	3,542.2
Impact BIO#26b: Loss of Denning and Dispersal Habitat for and Direct Mortality or Disturbance of San Joaquin Kit Fox	The project would remove or disturb habitat for San Joaquin kit fox, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals by crushing occupied burrows or collapsing burrow entrances and preventing escape. Activities could also disturb individuals and impair breeding, feeding, or sheltering behavior. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on San Joaquin kit fox under all alternatives.			
Habitat for San Joaquin kit fox	2,881.6	2,881.6	2,914.4	2,881.0
Impact BIO#27: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Fresno Kangaroo Rat	The project would remove or disturb habitat for Fresno kangaroo rat. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct impacts on Fresno kangaroo rat under all alternatives.			
Habitat for Fresno kangaroo rat	105.1			
Impact BIO#28: Loss of Denning and Dispersal Habitat for and Direct Mortality or Disturbance of American Badger	The project would remove or disturb habitat for American badger, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals by crushing occupied burrows or collapsing burrow entrances and preventing escape. Activities could also disturb individuals and impair breeding, feeding, or sheltering behavior. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on American badger under all alternatives.			
Habitat for American badger	1,173.1	1,204.7	1,178.5	1,129.1
Impact BIO#29: Permanent Conversion or Degradation of Habitat for and Direct Mortality of San Francisco Dusky-Footed Woodrat and Ringtail	The project would remove or disturb habitat for San Francisco dusky-footed woodrat and ringtail. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct impacts on San Francisco dusky-footed woodrat and ringtail under all alternatives.			
Habitat for San Francisco dusky-footed woodrat and ringtail	502.4	512.8	513.3	479.9
Impact BIO#30: Loss of Roost Sites for and Direct Mortality or Disturbance of Special-Status Bats	The project would remove roosting habitat for pallid bat, Townsend's big-eared bat, western mastiff bat, and western red bat. Activities could also destroy or cause abandonment of occupied roost sites, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct impacts on these species under all alternatives.			
Habitat for pallid bat	4,128.3	4,813.3	4,205.2	3,559.3
Habitat for Townsend's big-eared bat	2,120.9	2,370.4	2,318.0	1,850.5
Habitat for western mastiff bat	3,415.9	4,102.6	3,492.8	2,858.9
Habitat for western red bat	4,594.7	5,287.7	4,682.6	4,012.5

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Non-Special-Status Species				
Impact BIO#33: Mortality of Non-Special-Status Terrestrial Wildlife	The project could result in mortality of non-special-status terrestrial wildlife by crushing or mangling small ground-dwelling animals hidden underground or in dense vegetation, inadvertently releasing hazardous materials into aquatic habitat, or removing vegetation and structures that support non-special-status birds and bats. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct impacts on non-special-status wildlife under Alternative 1.	Impacts under Alternative 2 would be the same as under Alternative 1. There are no non-special-status wildlife species or activity types unique to one alternative; all have the same potential to result in direct impacts.	Impacts under Alternative 3 would be the same as under Alternative 1. There are no non-special-status wildlife species or activity types unique to one alternative; all have the same potential to result in direct impacts.	Impacts under Alternative 4 would be the same as under Alternative 1. There are no non-special-status wildlife species or activity types unique to one alternative; all have the same potential to result in direct impacts.
Impact BIO#34: Removal or Degradation of Habitat for and Disturbance of Waterfowl and Shorebirds	The project would remove or disturb habitat for waterfowl and shorebirds in two Audubon IBAs, and could degrade habitat outside of but adjacent to the project footprint. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on waterfowl and shorebird habitat under Alternative 1.	Impacts under Alternative 2 would the same as under Alternative 1 because its footprint is identical where it crosses the Audubon IBAs.	Impacts under Alternative 3 would be similar to but greater than under Alternative 1 because Alternative 3 would cross more of the 10-year Soap Lake floodplain and agricultural lands east of Gilroy.	Impacts under Alternative 4 would the same as under Alternative 1 because its footprint is identical where it crosses the Audubon IBAs.
Special-Status Plant Communities				
Impact BIO#35: Permanent Conversion or Degradation of Special-Status Plant Communities	The project would remove or disturb the following special-status plant communities, and could degrade special-status plant communities adjacent to the project footprint. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on special-status plant communities under all alternatives.			
Alkali marsh	9.7			
Alkali scrub wetland	0.9			
Alkali vernal pool	27.1			
California annual grassland	1,138.4	1,166.4	1,144.0	1,091.9
California sycamore woodland	12.6			
Freshwater marsh	2.3	2.4	11.3	2.3
Mixed chaparral	19.6	19.6	19.5	19.6
Mixed riparian	26.3	27.6	30.3	20.9
Palustrine forested wetland	31.9	31.5	26.3	27.9
Seasonal wetland	16.2	16.4	13.9	11.6
Vernal pools	0.4			
Total area of special-status plant communities affected	1,269.4	1,299.0	1,281.3	1,209.9
Aquatic Resources				
Impact BIO#37: Permanent Conversion or Degradation of Aquatic Resources Considered Jurisdictional under Section 404 of the Federal Clean Water Act or Regulated by the State	The project would remove or disturb federally protected wetland and nonwetland cover types (i.e., aquatic resources), and could degrade aquatic resources outside of but adjacent to the project footprint. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on aquatic resources under all alternatives.			
Wetlands	58.2 (P) 19.3 (T)	58.1 (P) 19.6 (T)	67.8 (P) 11.9 (T)	56.2 (P) 13.6 (T)
Nonwetlands	42.3 (P) 68.3 (T)	49.9 (P) 69.9 (T)	43.0 (P) 68.8 (T)	40.4 (P) 64.7 (T)

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Total jurisdictional aquatic resources (permanent and temporary impacts total)	188.0	197.4	191.5	174.8
Impact BIO#38: Permanent Conversion or Degradation of Resources Regulated under California Fish and Game Code Section 1600 et seq.	The project would remove or disturb riparian habitat and aquatic resources subject to regulation under Section 1600 et seq., which may have a substantial adverse effect on fish and wildlife species. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on aquatic resources under all alternatives.			
Riparian habitat	55.1	56.1	54.5	46.4
Rivers, lakes, and streams	126.2	137.0	112.2	105.1
Total aquatic resources	181.3	193.1	166.7	151.5
Protected Trees				
Impact BIO#40: Removal of Trees Protected under Municipal Tree Ordinances	The project may remove or prune trees protected under municipal tree ordinances. Ground disturbance could result in increased invasive weed cover that reduce the viability and regeneration of protected trees. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on protected trees under all alternatives.			
Wildlife Corridors				
Impact BIO#42: Temporary Disruption of Wildlife and Wildlife Movement	The project would temporarily affect wildlife and wildlife movement by creating temporary barriers to movement (e.g., construction fencing and dewatering), creating noise and vibration that alters or delays animal movements as they attempt to avoid the work area, and introducing ALAN during nighttime construction that alters or delays animal movements as they avoid lit areas. The project could affect gene flow between subpopulations of mountain lions by temporarily precluding mountain lion movements. Wildlife exclusion fencing, and construction work windows would minimize temporary direct and indirect impacts on wildlife movement under all alternatives.	Impacts under Alternative 2 would be less than under Alternative 1 because Alternative 2 would stay within instead of circumvent downtown Morgan Hill, thus avoiding agricultural lands and staying farther from Coyote Creek, a known wildlife movement corridor. Alternative 2 would have the lowest temporary impact on wildlife movement of the four alternatives.	Impacts under Alternative 3 would be greater than those under Alternative 1 because Alternative 3 would cross more land protected to conserve wildlife movement and more of the Santa Cruz to Gabilan Range modeled wildlife corridor in the Soap Lake 10-year floodplain than the other alternatives. Alternative 3 would have the greatest temporary impact on wildlife movement of the four alternatives.	Impacts under Alternative 4 would be similar to those under Alternative 2.
Impact BIO#43: Permanent Impacts on Wildlife Movement	The project would create a barrier to local and regional wildlife movement and fragment habitat. The project could affect the gene flow between subpopulations of mountain lions by precluding mountain lion movements. Dedicated wildlife crossings and modification of viaducts and drainage culverts to facilitate wildlife movement as proposed in the WCA would minimize permanent direct impacts on wildlife movement.	Impacts on terrestrial wildlife movement under Alternative 2 would be greater than under Alternative 1 because the alignment profile is at grade (rather than viaduct) through most portions of the Monterey Corridor and Morgan Hill and Gilroy Subsections, precluding the movement of several species.	Impacts under Alternative 3 would be greater than under Alternatives 1 and 2 because Alternative 3 would cross more of the Soap Lake floodplain and more undeveloped agricultural lands than these alternatives, and it would also result in more in-water impacts on aquatic species movement due to greater impacts on Llagas Creek.	Impacts under Alternative 4 would be similar to those under Alternative 2.
Conservation Areas				
Impact BIO#51: Permanent Conversion or Degradation of Conservation Areas	The project would remove or disturb conservation area lands, and could degrade conservation area lands outside of but adjacent to the project footprint. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on jurisdictional aquatic resources under all alternatives.			
Acres of conservation areas affected	535.8	564.8	595.7	539.0
Number of conservation areas affected	11	14	11	9

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Habitat Conservation Plans				
Impact BIO#53: Conflict with Santa Clara Valley Habitat Plan	The project could conflict with the following conservation actions of the SCVHP: ▪ Action LAND-L4 requires the acquisition and enhancement of natural and semi-natural landscapes between the Santa Teresa Hills and Metcalf Canyon to the south that will contribute to providing connectivity between the Santa Cruz Mountains and Diablo Range to promote the movement of covered and other native species at many spatial scales. ▪ Action LAND-WP7 requires the acquisition of habitat near Santa Teresa Hills and Tulare Hill to provide connectivity between populations in the Diablo Range and the Santa Cruz foothills. ▪ Action LAND-R3 requires the acquisition in fee title of or obtaining conservation easements on lands that protect at least 40 acres of existing California sycamore woodland so that this very rare and threatened land cover type is preserved in the study area. Potential conflicts with Actions LAND-L4 and LAND-WP7 are not expected in that the project would not interfere with land acquisition because the project alternatives would be located in areas outside the areas identified for acquisition. There would be a potential conflict with Action LAND-R3 because the SCVHA is in the process of obtaining a conservation easement to protect California sycamore woodland along Pacheco Creek at the Pacheco Creek Open Space Regional Reserve, and the project would have permanent and temporary direct impacts within the area targeted for protection.			
Impact BIO#54: Conflict with Santa Clara Valley Greenprint	The project would not conflict with the Santa Clara Valley Greenprint. Strategy 3 of the Greenprint includes the goal of protecting and maintaining connections between large open-space parcels to provide large habitat blocks, critical linkages, and climate resilience. The project would cross three of ten conservation focus areas identified under Strategy 3: Coyote Valley, Upper Pajaro River, and Coyote Creek. However, the Greenprint does not identify quantitative goals or strategies for these areas. In addition, Alternative 3 would affect protected parcels identified by the Greenprint as important for agricultural land protection (Bloomfield North and Bloomfield South easements), but these parcels are not included in its habitat conservation goals. Since the project (all alternatives) would not prevent the successful implementation of any Greenprint strategy, and since the project would not preclude implementation of the Greenprint in any of the conservation focus areas that would be affected by the project (all alternatives), nor would the impacts on conservation parcels result in a substantial impact on Greenprint implementation, the project alternatives would not conflict with implementation of the Greenprint.			
Impact BIO#55: Conflict with Coyote Valley Linkage	Construction of the project alternatives would result in potential conflicts with two recommended wildlife crossing modifications proposed under the Coyote Valley Linkage: a wildlife overpass at Metcalf Canyon Road or at Bailey Road and a wildlife undercrossing at Blanchard Road. HSR would not prohibit implementation of the Coyote Valley Linkage Plan under any alternative; however, it would increase the complexity of construction and incrementally increase the length of the proposed crossings (except under Alternative 4).			
Hydrology and Water Resources				
Surface Water Hydrology				
Impact HYD#1: Temporary Impacts on Drainage Patterns and Stormwater Runoff during Construction	Changes to surface water hydrology that result in erosion and sedimentation would occur in 94 waterbodies with minor disturbances, and construction activities would occur in 232 waterbodies. Maintaining drainage patterns to the extent feasible, a SWPPP under the CGP, and adhering to regulatory permits would minimize potential impacts on surface water hydrology.	Impacts under Alternative 2 would be similar to Alternative 1; however, two fewer waterbodies would have minor disturbances (92) and 14 more waterbodies would be disturbed by construction activities (246).	Impacts under Alternative 3 would be similar to Alternative 1; however, the same quantity of waterbodies would have minor disturbances (94) and two fewer waterbodies would be disturbed by construction activities (230).	Impacts under Alternative 4 would be similar to Alternative 1; however, two fewer waterbodies would have minor disturbances (92) and seven fewer waterbodies would be disturbed by construction activities (225).
Impact HYD#2: Permanent Impacts on Drainage Patterns and Stormwater Runoff during Construction	Grading, cut-and-fill slopes, impervious surfaces, new bridges and culverts, and realigned or modified waterbodies would result in minimal changes to drainage patterns and stormwater runoff. New rail and roadway crossings would maintain drainage patterns of 152 waterbodies; 132 waterbodies would be realigned or filled; there would be 52,944,372 cubic yards of cut and fill; and 1,419.2 acres of impervious surface would be constructed or reconstructed. Maintaining drainage patterns and pre-construction flow rates, a stormwater management and treatment plan, and the design of realigned or modified waterbodies would minimize permanent impacts on surface water hydrology.	Impacts under Alternative 2 would be similar to Alternative 1; however, the same quantity waterbodies would have new railroad and roadway crossings (152), 11 more waterbodies would be realigned or filled (143), there would be more cut and fill (53,181,504 cubic yards), and the largest amount of impervious surface would be constructed (1,642.1 acres).	Impacts under Alternative 3 would be similar to Alternative 1; however, fewer waterbodies would have seven fewer new railroad and roadway crossings (145), four fewer waterbodies would be filled or realigned (128), and a smaller area of impervious surface would be constructed (1,358.9 acres), but it would require the most cut and fill (55,524,808 cubic yards).	Impacts under Alternative 4 would be similar to Alternative 1; however, 11 fewer waterbodies would have new railroad and roadway crossings (141), 11 fewer waterbodies would be filled or realigned (121), a smaller area of impervious surface would be constructed 919.3 acres), and it would require the least cut and fill (52,674,633 cubic yards).

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Surface Water Quality				
Impact HYD#4: Temporary Impacts on Surface Water Quality during Construction	Grading, excavation, work in waterbodies, temporary stream diversion, and other activities that would disturb, destabilize, and stockpile soil would result in temporary impacts on surface water quality. Runoff from 4,936 acres of disturbed soil would be controlled to prevent elevated turbidity and sedimentation in receiving waterbodies. Construction activities would occur in 232 waterbodies, 139 of which would be temporarily diverted and dewatered, which would physically disturb waterbodies and may require removal of riparian vegetation. Applying construction site BMPs in accordance with a SWPPP and the CGP and adhering to regulatory permit conditions would reduce temporary water quality impacts.	Impacts under Alternative 2 would be similar to Alternative 1; however, construction would disturb a larger area of soil (5,642 acres); disturb the bed, banks, and vegetation in 14 more waterbodies (246); and require temporarily diverting and dewatering 10 more waterbodies (149).	Impacts under Alternative 3 would be similar to Alternative 1; however, construction would disturb a larger area of soil (5,031 acres); disturb the bed, banks, and vegetation in two fewer waterbodies (230); and require temporarily diverting and dewatering two fewer waterbodies (137).	Impacts under Alternative 4 would be similar to Alternative 1; however, however, construction would disturb the smallest area of soil (4,336 acres); disturb the bed, banks, and vegetation in the seven fewer waterbodies (225); and require temporarily diverting and dewatering the six fewer waterbodies (133).
Impact HYD#5: Permanent Impacts on Surface Water Quality during Construction	Land use change, impervious surfaces, and realigned or filled waterbodies would permanently affect surface water quality. Alternative 1 would construct or reconstruct 1,419.2 acres of impervious surfaces, much of which would be new impervious surface associated with a viaduct between San Jose and Gilroy. Implementing a stormwater management and treatment plan would manage the quality and quantity of runoff generated by impervious surfaces. However, 132 waterbodies would be realigned or filled, resulting in permanent conversion or loss of aquatic resources and riparian vegetation.	Impacts under Alternative 2 would be similar to Alternative 1; however, Alternative 2 would construct the largest area of impervious surface (1,642.1 acres) from the construction of grade separations in the Morgan Hill and Gilroy Subsection and would fill, realign, or modify the 11 more waterbodies (143).	Impacts under Alternative 3 would be similar to Alternative 1; however, Alternative 3 would add or replace a smaller area of impervious surfaces (1,358.9 acres) and fill, realign, or modify four fewer waterbodies (128).	Impacts under Alternative 4 would be similar to Alternative 1; however, Alternative 4 would create the smallest area of new or reconstructed impervious surfaces (919.3 acres) and fill, realign, or modify the 11 fewer waterbodies (121) by using existing Caltrain infrastructure between San Jose and Gilroy.
Groundwater				
Impact HYD#8: Temporary Impacts on Groundwater Quality and Volume during Construction	Dewatering, excavations, and accidental leaks and spills of materials and waste would minimally affect groundwater quality and volume. Impacts would be reduced by adhering to the RWQCBs' dewatering requirements; a construction management plan; coordination with utility providers and the RWQCBs; and implementing BMPs and project features regarding the management, transport, and disposal of construction waste and materials.	Impacts under Alternative 2 would be greater than Alternative 1, because more excavations due to the trenches, road improvements, and additional structures could potentially result in more dewatering.	Impacts under Alternative 3 would be similar to Alternative 1, as a comparable number of structures would require excavation and potential dewatering.	Impacts under Alternative 4 would be slightly less than under Alternative 1, because there would be fewer structures requiring excavation and therefore potentially less dewatering would be required.
Impact HYD#9: Permanent Impacts on Groundwater Quality and Volume during Construction	New impervious surfaces in groundwater subbasins (1,303.0 acres) and recharge zones in the Santa Clara and Llagas Area subbasins (314.0 and 158.8 acres, respectively), shallow subsurface structures, and relocating or protecting 4 public drinking water supply wells would minimally affect groundwater quality and volume. Alternative 1 would reduce groundwater percolation capacity at the Gilroy Wastewater Treatment Ponds. Permanent stormwater BMPs and coordination with the RWQCBs and water utility providers would minimize impacts, but not avoid impacts entirely.	Impacts under Alternative 2 would be similar to Alternative 1; however, the largest area of impervious surface would be constructed in groundwater subbasins (1,533.7 acres) and recharge zones, eight more public drinking water supply wells (12) would be protected or relocated, and percolation capacity at the Gilroy Wastewater Treatment Ponds would be reduced.	Impacts under Alternative 3 would be less than Alternative 1; as a smaller area of impervious surface would be constructed in groundwater subbasins (1,241.4 acres), a smaller area of impervious surface would be constructed in groundwater recharge zones, one public drinking water supply well would be protected or relocated (5), and percolation capacity at the Gilroy Wastewater Treatment Ponds would not be reduced.	Impacts under Alternative 4 would be similar to Alternative 1; as the smallest area of impervious surface would be constructed in groundwater subbasins (802.9 acres), the smallest area of impervious surface would be constructed in groundwater recharge zones, eight more public drinking water supply wells would be protected or relocated (12), and percolation capacity at the Gilroy Wastewater Treatment Ponds would not be reduced.

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact HYD#10: Temporary Impacts on Groundwater and Surface Water Hydrology during Tunnel Construction	Tunnel construction activities have the potential to substantially decrease groundwater supplies and reduce groundwater contributions to surface water flows. The highest potential for these impacts to occur are along Tunnel 2 in the highest elevations of the Pacheco Pass corridor near the Santa Clara/Merced County boundary as well as at the Ortigalita fault zone. In these areas, there is potential for substantial drawdown of groundwater resources and effects on interconnected surface water resources, even with project features that govern tunnel construction methods and tunnel waterproofing specifications.	Impacts under Alternative 2 would be the same as Alternative 1, because they share the same proposed tunnels.	Impacts under Alternative 3 would be the same as Alternative 1, because they share the same proposed tunnels.	Impacts under Alternative 4 would be the same as Alternative 1, because they share the same proposed tunnels.
Impact HYD#11: Permanent Impacts on Groundwater and Surface Water Hydrology from Tunnel Construction	The proposed tunnels would be designed to be as watertight as possible by installing a single-pass or double-pass liner to withstand full hydrostatic groundwater pressures and resist groundwater inflows after construction of the tunnels has been completed. Substantial permanent impacts on groundwater and surface water hydrology would be avoided, because the tunnels would be designed to be watertight and avoid permanent drawdown of groundwater resources.	Impacts under Alternative 2 would be the same as Alternative 1, because they share the same specifications for waterproofing the proposed tunnels.	Impacts under Alternative 3 would be the same as Alternative 1, because they share the same specifications for waterproofing the proposed tunnels.	Impacts under Alternative 4 would be the same as Alternative 1, because they share the same specifications for waterproofing the proposed tunnels.
Floodplains				
Impact HYD#14: Temporary Impacts on Floodplain Hydraulics during Construction	Construction would require temporary fill in existing 100-year floodplains. Potential temporary floodplain impacts would be minimized by monitoring weather forecasts, coordinating with water and irrigation districts regarding planned releases from dams, and removing temporary fill from waterbodies and floodplains when flooding may occur.	Impacts under Alternative 2 would be similar to Alternative 1; however, different floodplains would be affected by different alignments in the Morgan Hill and Gilroy Subsection and a larger footprint.	Impacts under Alternative 3 would be similar to Alternative 1; however, different floodplains would be affected by different alignments in the Morgan Hill and Gilroy Subsection.	Impacts under Alternative 4 would be similar to Alternative 1; however, different floodplains would be affected by different alignments in the Morgan Hill and Gilroy Subsection and a smaller footprint.
Impact HYD#15: Permanent Impacts on Floodplain Hydraulics during Construction	Construction would require cut and fill in floodplains, including bridges, culverts, roadways, embankments, viaducts, trenches, stations, maintenance facilities, realignment and modification of waterbodies, and utility upgrades. The development and implementation of a flood protection plan and coordination with the U.S. Army Corps of Engineers would minimize permanent impacts on floodplains, including the Soap Lake floodplain south of Gilroy.[1]	Impacts under Alternative 2 would be similar to Alternative 1; however, Alternative 2 would cross different floodplains.	Impacts under Alternative 3 would be similar to Alternative 1; however, Alternative 3 would increase the 100-year water surface elevation of the Llagas Creek floodway near east Gilroy by approximately 0.4 foot.	Impacts under Alternative 4 would be similar to Alternative 1; however, Alternative 4 would cross different floodplains.
Geology, Soils, Seismicity, and Paleontological Resources				
Impact GEO#1: Construction in Unstable Soils	Project features will minimize direct and indirect risks to life and property from differential ground movement caused by ground subsidence, collapsible soil, landslides, soft soil by conducting site condition assessments, subsidence monitoring, controlling groundwater withdrawal, and implementing geotechnical engineering practices in accordance with relevant design guidelines and standards such as AREMA, FHWA, and Caltrans. A CMP will also be developed to specify how and where these techniques will be implemented.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact GEO#2: Inadvertent Disturbance of Naturally Occurring Asbestos during Construction	Project features will minimize direct and indirect risks caused by exposure of construction workers to NOA by conforming with regulatory requirements for construction and grading operations in areas with NOA and employing measures to reduce the potential for NOA to become airborne during ground-disturbing activities and by proper testing and disposal of excavated material that may contain NOA. A CMP will also be developed to specify how and where these techniques will be implemented.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact GEO#3: Exposure to In-Situ Gas	Project features will minimize direct and indirect risks to life and property from exposure inhalation or explosion of hazardous in-situ gas by conforming with OSHA regulatory requirements for excavations, installing gas monitoring, collecting, and ventilating systems, and using explosion-proof equipment. A CMP will also be developed to specify how and where these techniques will be implemented.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact GEO#4: Tunneling in Areas with Sheared or Weak Bedrock	Project features will minimize direct and indirect risks to life and property from unstable sheared or weak bedrock by assessing geotechnical conditions prior to construction, using tunneling techniques to safely tunnel when crushing and squeezing conditions are expected, and reinforcing tunnels to handle external stresses. A CMP will also be developed to specify how and where these techniques will be implemented.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact GEO#5: Construction on Expansive Soil	Project features will assess soil conditions and treat expansive soils through appropriate engineering measures, thereby minimizing direct and indirect risks to life and property from differential ground movement caused by expansive soil. Engineering measures will include treatment with soil additives to reduce shrink-swell potential or excavation and replacement in accordance with relevant guidelines and standards such as AREMA, FHWA, and Caltrans. A CMP will also be developed to specify how and where these techniques will be implemented.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact GEO#6 Excavating in Areas with Shallow Bedrock or Shallow Groundwater	Project features will minimize direct and indirect risks to life and property by conforming with geotechnical guidelines and standards such as AREMA, FHWA, and Caltrans, undertaking geotechnical investigations so that contractor would use safe equipment and techniques, and developing a CMP pertaining to excavations, shallow bedrock, and groundwater conditions.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact GEO#7: Exposure of Concrete and Steel to Corrosive Soils	Project features will minimize direct and indirect risks to life and property from corrosive soils by conforming to guidelines specified by relevant transportation and building codes such as AREMA, FHWA, Caltrans, and CBC. and developing a CMP that will include standard engineering and construction methods to avoid or minimize the impacts of corrosive soil during construction.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact GEO#8: Excavation and Grading Impacts on Soil Erosion	Project features will minimize substantial soil erosion or the loss of topsoil that would adversely affect the viability of the ecosystem or productivity of farming through the adoption of BMPs that protect exposed soil, include soil stabilization through the use of stabilizers, mulches, revegetation, and covering exposed work areas with biodegradable geotextiles.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact GEO#9: Primary Seismic Hazards during Construction	Project features will minimize direct and indirect risks to life and property from surface fault rupture and ground shaking during construction. All HSR components would be designed for the impacts of earthquakes and seismic ground shaking. Project features include seismic studies, the implementation of a CMP that will include design measures to minimize or avoid exposure of people or structures to impacts, including worker safety protocols for seismic events that could occur during construction, and compliance with guidelines and standards such as AREMA, FHWA, Caltrans, and CBC.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact GEO#10: Secondary Seismic Hazards during Construction	Project features will minimize direct and indirect risks to life and property resulting from ground deformation from secondary seismic hazards during construction. These project features include conforming to guidelines specified by relevant transportation and building agencies including assessing geotechnical conditions prior to construction and applying geotechnical engineering practices such as ground improvement and foundation design as well as applying construction safety measures like evacuation plans. A CMP will also be developed to specify how and where these practices and measures will be implemented.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Paleontological Resources				
Impact GEO#14: Destruction of Paleontological Resources during Construction	Construction of the project could affect eight geologic units identified as having high or undetermined paleontological potential. Excavation that extends deep enough to encounter sensitive geologic units underlying areas mapped as low-potential younger alluvium have the potential to result in impacts on paleontological resources. Alternative 1 would result in more ground disturbance in paleontologically sensitive geologic units in the Morgan Hill and Gilroy Subsection than Alternative 2 and Alternative 3 as it traverses to east Gilroy. Viaduct and embankment elements under Alternative 1 include more ground disturbance in paleontologically sensitive geologic units than Alternative 4 in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections.	Alternative 2 would have the potential to result in fewer impacts on paleontological resources than Alternatives 1 or 3 because it would use an embankment from Bernal Way to downtown Gilroy, which would involve substantially less excavation than Alternatives 1 and 3. Viaduct and embankment elements under Alternative 2 include more ground disturbance in paleontologically sensitive geologic units than Alternative 4 in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections.	Viaduct elements in Alternative 3 would result in less ground disturbance in paleontologically sensitive geologic units in the Morgan Hill and Gilroy Subsection than viaduct elements in Alternative 1, but would have more ground disturbance than the embankment under Alternative 2. Viaduct and embankment elements under Alternative 3 also include more ground disturbance in paleontologically sensitive geologic units than Alternative 4 in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections.	Alternative 4 would result in less ground disturbance in paleontologically sensitive geologic units than Alternatives 1, 2, or 3 because it would use a blended, at-grade profile in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections, which would involve substantially less excavation than the viaducts and embankments proposed under the other alternatives.
Hazardous Materials and Waste				
Impact HMW#1: Temporary and Intermittent Impacts from the Transport, Use, Storage, and Disposal of Hazardous Materials and Wastes during Construction	The project would not increase the risk of injury or death to the public, workers, or the environment during construction, because project features will require compliance with regulations that control the transport, use, and storage of hazardous materials; proper permitting; and the implementation of written hazard communication and spill prevention plans to avoid worker and public exposure to hazardous materials.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact HMW#2: Temporary Impacts from Construction on or near Potential Environmental Concern Sites	Construction of the project could affect 21 medium- and high-risk PEC sites within the PEC RSA. Project features will include characterizing contamination before it is disturbed, managing required disturbances, stopping work if undocumented contamination is discovered, and implementing engineering controls to limit spread and exposure to hazardous materials.	Similar to Alternative 1, but construction could affect 28 medium- and high-risk PEC sites within the PEC RSA.	Similar to Alternative 1, but construction could affect 17 medium- and high-risk PEC sites within the PEC RSA.	Similar to Alternative 1, but construction could affect 29 medium- and high-risk PEC sites within the PEC RSA.

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact HMW#3: Temporary Direct Effects from Inadvertent Disturbance of Former or Current Railways during Construction	The risk assessment determined that the potential for disturbing former railways is low in the Pacheco Pass and San Joaquin Valley Subsections and high in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections. Project features will include a CMP that addresses provisions for the disturbance of undocumented contamination and the implementation of a hazardous waste plan for handling, transport, containment, and storage of hazardous materials.	Alternative 2 parallels a larger portion of current railway in the Morgan Hill and Gilroy Subsection, and therefore has a slightly higher risk than Alternative 1.	Similar to Alternative 1.	Alternative 4 follows a larger portion of current railway in the Morgan Hill and Gilroy Subsection, and therefore has the highest risk of all the alternatives.
Impact HMW#4: Temporary Impacts from Inadvertent Disturbance of Lead-Based Paint during Construction	The risk assessment determined that the potential for encountering structures with LBP is low in the Pacheco Pass and San Joaquin Valley Subsections and moderate in the other subsections. Project features will include implementation of a hazardous waste plan for transport, containment, and storage of hazardous materials and preparation of demolition plans with provisions for lead abatement and control measures to minimize potential exposure of the public and constructions workers to lead.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact HMW#5: Temporary Impacts from Inadvertent Disturbance of Asbestos-Containing Materials during Construction	The risk assessment determined that the potential for encountering structures or soils containing asbestos materials is high in the San Jose Diridon Station Approach and Monterey Corridor Subsections, moderate in the Morgan Hill and Gilroy Subsection, and low in the remaining two subsections. Project features will include implementation of a hazardous waste plan for transport, containment, and storage of hazardous materials and preparation of demolition plans with provisions for ACM abatement and control measures to minimize potential exposure of the public and constructions workers to asbestos. Plans will require handling of materials be done by licensed asbestos contractors.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact HMW#6: Temporary Impacts from Inadvertent Disturbance of Pesticides during Construction	The risk assessment determined that the risk of encountering pesticides is high in the Morgan Hill and Gilroy and San Joaquin Valley Subsections and low in the remaining subsections. Pesticides are a relatively confined contaminant with a low likelihood of mobilization, and project features will include measures to mitigate undocumented contaminants encountered during earth-disturbing activities.	Same as Alternative 1.	Alternative 3 passes through slightly more agricultural land than Alternatives 1, 2, and 4 in the Morgan Hill and Gilroy Subsection; accordingly, Alternative 3 has a slightly higher risk of exposure to potentially pesticide-contaminated soils.	Same as Alternative 1.
Impact HMW#7: Temporary Impacts from Inadvertent Disturbance of Polychlorinated Biphenyls during Construction	There are pole-mounted transformers within RSA under which PCB concentrations may be found. The risk assessment determined that the risk of encountering PCBs is moderate in all subsections. Project features will require preparation of a CMP for disturbances of undocumented contamination, work stoppage until a contaminant can be characterized, and implementation of appropriate controls to limit exposure to PCBs and development of a hazardous materials and waste plan describing responsible parties and procedures and BMPs for transport, containment, and storage of contaminated materials.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact HMW#8: Temporary Impacts from Inadvertent Disturbance of Aerially Deposited Lead during Construction	The risk assessment determined that the risk of encountering ADL is moderate in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections and low in the remaining subsections. Project features will include identification and characterization of areas potentially contaminated with ADL prior to construction, preparation of a CMP with provisions for the disturbance of undocumented contamination and restricting handling of contaminated soils to personnel trained in their management, wetting of soils during construction, and the provision of a hazardous materials and waste plan describing responsible parties and procedures and BMPs for transport, containment, and storage of contaminated materials.	There is a slightly higher risk of ADL exposure in the Morgan Hill and Gilroy Subsection under Alternative 2 than under Alternatives 1, 3, and 4.	Same as Alternative 1.	Same as Alternative 1.
Impact HMW#9: Temporary Impacts from Soil Disturbing Activities in Areas of Naturally Occurring Asbestos during Construction	The risk assessment determined that the risk of encountering NOA is moderate in the Monterey Corridor, Morgan Hill and Gilroy, and Pacheco Pass Subsections, and low in the remaining subsections. Project features will include testing for NOA, controlling for dust, having a geologist or other trained professional on-site when working in areas with potential for NOA, and stopping work when an NOA deposit is encountered until a management plan has been prepared and implemented.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact HMW#10: Temporary Impacts from Inadvertent Disturbance of Undocumented Hazardous Materials or Wastes during Construction	Project features will include preparation of a CMP, placing work barriers prior to construction in areas suspected of contamination and during construction if contamination is encountered, stopping work if undocumented contamination is encountered, and characterization and removal of contaminated materials prior to resuming work.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Hazardous Material and Waste Impacts on Sensitive Receptors				
Impact HMW#12: Intermittent Impacts from Hazardous Materials and Wastes Activities in Proximity to Schools During Construction	Project construction would occur within 0.25 mile of 43 schools. Project features will require compliance with federal, state, and local regulations; selection of materials to minimize potential for exposure; and use of HMBPs and environmental management plans to identify, track, and document the locations of hazardous materials and to promote proper handling, storage, and transport of hazardous materials. Proper implementation of the materials storage procedures as outlined in the HMBP will limit the extent of any spilled material within a storage area to that storage facility.	Similar to Alternative 1, but construction would occur within 0.25 mile of 47 schools.	Similar to Alternative 1, but construction would occur within 0.25 mile of 41 schools.	Similar to Alternative 1, but construction would occur within 0.25 mile of 40 schools.
Safety and Security				
Emergency Response and Services				
Impact S&S#1: Temporary Impacts on Emergency Access and Response Times from Temporary Roadway and Highway Closures, Relocations, and Modifications	Travel time on Monterey Road would increase throughout construction areas for the duration of construction activities, resulting in delays in emergency vehicle access and response time. Access roads and driveways at Morgan Hill Charter School would be closed or modified, impeding emergency access to the school.	Temporary construction activity would result in the same road closures and relocations as Alternative 1. Construction of Skyway Drive Variant A would not impede vehicle access to San Jose Fire Station 18. Construction of Skyway Drive Variant B would impede vehicle access to San Jose Fire Station 18.	Same as Alternative 1, except no effects on Morgan Hill Charter School.	Travel time on Monterey Road would increase throughout construction areas for the duration of construction activities, resulting in delays in emergency vehicle access and response time. Effects under Alternative 4 would be less due to the lack of roadway narrowing on Monterey Road.
Impact S&S#2: Temporary Impacts on Emergency Access and Response Times from Construction Vehicles	Project features will manage construction vehicle traffic and the project would not affect emergency vehicle access and response.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Community Safety and Security				
Impact S&S#5: Temporary Exposure to Criminal Activity at Construction Sites	Construction sites would not result in criminal activity risks that would interfere with emergency services. The risk of criminal activity on construction sites would be minimized by storing equipment and materials in secured areas and using security personnel and security lighting to monitor equipment after work hours.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact S&S#6: Temporary Exposure to Construction Site Hazards	Construction equipment, construction activities, and high-risk facilities would not result in safety hazards. The project would comply with all legal requirements and include an effective safety plan to reduce the potential of construction site hazards and accidents.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact S&S#7: Temporary Exposure to Construction-Related Traffic Hazards	Temporary construction activities would result in 10 temporary road closures and realignments affecting Caltrans facilities. Emergency vehicle access would be maintained during construction and road closures would be staggered so that the next adjacent road to the north and south of a road temporarily closed for construction would remain open to accommodate detoured traffic.	Same as Alternative 1.	Same as Alternative 1.	Temporary construction activities would result in 8 temporary road closures and realignments affecting Caltrans facilities. Emergency vehicle access would be maintained during construction and road closures would be staggered so that the next adjacent road to the north and south of a road temporarily closed for construction would remain open to accommodate detoured traffic.
Impact S&S#10: Temporary Exposure to Valley Fever	Construction would not lead to increased risk of exposure to Valley fever. The fugitive dust control plan and SSMP would minimize the exposure of the public or construction workers to Valley fever.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact S&S#11: Temporary Exposure to Risk from High-Risk Facilities	There are 129 high-risk utility facilities within the RSA prior to construction. 75 high-risk facilities would be relocated or removed during construction. The SSMP would identify high-risk facilities that could be affected by construction and remove, relocate, or protect-in-place pipelines, electrical systems, and other buried and overhead high-risk facilities within the project footprint.	There are 123 high-risk utility facilities within the RSA prior to construction. 78 high-risk facilities would be relocated or removed during construction. Construction worker protection would be the same as Alternative 1.	There are 127 high-risk utility facilities within the RSA prior to construction. 69 high-risk facilities would be relocated or removed during construction. Construction worker protection would be the same as Alternative 1.	There are 173 high-risk utility facilities within the RSA prior to construction. 80 high-risk facilities would be relocated or removed during construction. Construction worker protection would be the same as Alternative 1.
Socioeconomics and Communities				
Communities and Neighborhoods				
Impact SOCIO #1: Temporary Disruption or Division of Established Communities from Project Construction	Construction activity would disrupt existing circulation and access patterns for residents, businesses, and agricultural properties but would not physically divide existing communities. Monterey Road would be permanently reduced from six to four lanes between Capitol Expressway and Blossom Hill Road.	Same as Alternative 1, except construction activity would result in greater changes in access in the Monterey Corridor Subsection because of the need for new grade separations.	Same as Alternative 1, except disruption would occur in east Gilroy instead of downtown Gilroy for Alternatives 1 and 2.	Similar to Alternative 1, except there would be fewer disruptions in access in the Monterey Corridor Subsection and no need for narrowing of Monterey Road. Alternative 4 would have no grade separations.
Impact SOCIO #2: Permanent Disruption or Division of Established Communities	HSR infrastructure, including a viaduct rising up to 80 feet, would introduce permanent visual changes and disrupt the existing visual character along the project by adding a view of transportation infrastructure and precast yards for construction of 40 miles of viaduct.	Same as Alternative 1, except would add a view of transportation infrastructure and precast yards for construction of 18 miles of viaduct.	Same as Alternative 1, except would add a view of transportation infrastructure and precast yards for construction of 39 miles of viaduct.	Similar to Alternative 2, except the visual intrusion of HSR infrastructure would be less because of the at-grade, blended profile of Alternative 4.
Disruption or Division of Established Communities from Changes to Air Quality, Noise and Vibration, and Community Safety and Security (See Table 3.12-23 and Impact SOCIO#1)	Reductions in air quality could disrupt community activities, particularly outdoor activities at gathering places such as parks. Construction noise could exceed established noise thresholds and affect sensitive receptors such as schools, residences, daycare facilities, and hospitals. No changes in community safety and security.	Similar to Alternative 1, except construction noise impacts would be less than under Alternatives 1 and 3 because extensive pile driving would not be required in the Monterey Corridor and Morgan Hill and Gilroy Subsections.	Same as Alternative 1.	Impacts would be less than Alternatives 1, 2, and 3 because extensive pile driving would not be required and there would be fewer excavation and construction activities.

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Children's Health and Safety				
Impact SOCIO #4: Construction Impacts on Children's Health and Safety	Construction could result in long-term health impacts on children living, learning, and playing in the RSA.	Similar to Alternative 1, except that noise impacts along Monterey Road through downtown Gilroy would be less because of construction of embankment rather than viaduct, but emissions would be greater than under Alternatives 1, 3, and 4 because of a greater amount of earthwork and trenching.	Same as Alternative 1	Similar to Alternative 1, except that noise impacts along Monterey Road through downtown Gilroy would be less because of construction of an at-grade profile between San Jose and downtown Gilroy. There would be reduced emissions during construction because of the at-grade profile
Property Displacements and Relocations				
Impact SOCIO #6: Permanent Displacement and Relocation of Residential Properties	Construction of the project would displace 147 residential units. Sufficient available relocation properties exist in the region, but some residences in unincorporated Merced County and Volta may be unable to relocate within the same community.	Construction of the project would displace 603 residential units. Sufficient available relocation properties exist in the region, but some residences in Morgan Hill, San Martin, Gilroy, unincorporated Merced County, and Volta may be unable to relocate within the same community.	Construction of the project would displace 157 residential units. Sufficient available relocation properties exist in the region, but some residences in unincorporated Merced County and Volta may be unable to relocate within the same community.	Construction of the project would displace 68 residential units. Sufficient available relocation properties exist in the region, but some residences in unincorporated Merced County and Volta may be unable to relocate within the same community.
Impact SOCIO #7: Permanent Displacement and Relocation of Commercial and Industrial Facilities	Construction of the project would displace 217 businesses. Sufficient available relocation properties exist in the region, but some businesses in unincorporated Santa Clara County, San Martin, Gilroy, and unincorporated Merced County may be unable to relocate within the same community.	Construction of the project would displace 348 businesses. Sufficient available relocation properties exist in the region, but some businesses in unincorporated Santa Clara County, Morgan Hill, San Martin, Gilroy, and unincorporated Merced County may be unable to relocate within the same community.	Construction of the project would displace 157 businesses. Sufficient available relocation properties exist in the region, but some businesses in unincorporated Santa Clara County, San Martin, and unincorporated Merced County may be unable to relocate within the same community.	Construction of the project would displace 66 businesses. With the DDV, there would be partial acquisition of one additional commercial parcel and displacement of one additional commercial building. Sufficient available relocation properties exist in the region, but some businesses in San Martin, Gilroy, and unincorporated Merced County may be unable to relocate within the same community.
Impact SOCIO #8: Permanent Displacement and Relocation of Agricultural Properties	Construction of the project would displace 49 agricultural properties (including dairies). Sufficient available relocation properties exist in the region.	Construction of the project would displace 53 agricultural properties (including dairies). Sufficient available relocation properties exist in the region.	Construction of the project would displace 49 agricultural properties (including dairies). Sufficient available relocation properties exist in the region.	Construction of the project would displace 40 agricultural properties (including dairies). Sufficient available relocation properties exist in the region.
Impact SOCIO #9: Permanent Displacement and Relocation of Community and Public Facilities	Construction of the project would displace 8 community and public facilities.	Construction of the project would displace 9 community and public facilities, depending on the Skyway Drive variant selected.	Construction of the project would displace 6 community and public facilities.	Construction of the project would displace 1 community and public facility.
Economic Impacts				
Impact SOCIO #10: Construction Impacts on Employment	Construction of the project would provide 14,780 direct and indirect jobs, representing an increase in employment demand for the region.	Construction of the project would provide 12,650 direct and indirect jobs, representing an increase in employment demand for the region.	Construction of the project would provide 15,180 direct and indirect jobs, representing an increase in employment demand for the region.	Construction of the project would provide 10,670 direct and indirect jobs, representing an increase in employment demand for the region.
Construction Impacts on Population Growth (See Section 3.18, Regional Growth).	Construction of the project would not result in substantial direct population growth.	Same as Alternative 1, except that the indirect population growth would be anticipated to be greater because of the greater number of employment opportunities.	Same as Alternative 1, except that the indirect population growth would be anticipated to be greater because of the greater number of employment opportunities.	Same as Alternative 1, except that indirect population growth would be anticipated to be less because of the smaller number of employment opportunities.
Construction Impacts on School District Funding from Changes in Bus Transportation Costs (See Table 3.12-23)	Construction of the project would not result in changes in bus transportation costs.	Same as Alternative 1, except that the need for construction of grade separations would result in more extensive roadway closures and greater delays.	Same as Alternative 1, except that road closures would occur in east Gilroy rather than in downtown Gilroy.	Same as Alternative 1
Impact SOCIO #11: Construction Impacts on School District Funding from Student Relocations	Residential displacements would result in a maximum of 86 student relocations, representing a maximum of 1% of the total enrollment overall.	Same as Alternative 1, except residential displacements would result in a maximum of 318 student relocations, representing a maximum of 1% of the total enrollment overall.	Same as Alternative 1, except that residential displacements would result in a maximum of 91 student relocations, representing a maximum of 1% of the total enrollment overall.	Same as Alternative 1, except that residential displacements would result in a maximum of 47 student relocations, representing a maximum of 1% of the total enrollment overall.
Impact SOCIO #11: Construction Impacts on School District Funding from Reduced Property Tax Revenues	Decrease in property tax revenues from 147 residential displacements and a maximum of 86 student relocations would represent 0.000002% of total annual school funding sources.	Decrease in property tax revenues from 603 residential displacements and a maximum of 318 student relocations would represent 0.000005% of total annual school funding sources.	Decrease in property tax revenues from 157 residential displacements and 91 student relocations would represent 0.000002% of total annual school funding sources.	Decrease in property tax revenues from 68 residential displacements and 47 student relocations would represent 0.000001% of total annual school funding sources.

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact SOCIO #12: Construction Impacts on Agriculture Economy	Construction activities associated with Alternative 1 would require the temporary use of approximately 617.6 acres of Important Farmland, the permanent conversion of 1,035.5 of Important Farmland and 162.9 acres of waste management lands, an estimated total annual reduction in crop revenues of $7.2 million and annual dairy production loss of $5.4 million, and an estimated reduction of 92 agricultural and dairy jobs.	Construction activities associated with Alternative 2 would require the temporary use of approximately 658.7 acres of Important Farmland, the permanent conversion of 1,181.3 acres of Important Farmland and 244.3 acres of waste management lands, an estimated total annual reduction in crop revenues of $7.3 million and annual dairy production loss of $5.4 million, and an estimated reduction of 95 agricultural and dairy jobs.	Construction activities associated with Alternative 3 would require the temporary use of 672 acres of Important Farmland, permanent conversion of 1,192.5 acres of Important Farmland and 252.8 acres of waste management lands, an estimated total annual reduction in crop revenues of $7.8 million and annual dairy production loss of $5.4 million, and an estimated reduction of 107 agricultural and dairy jobs.	Construction activities associated with Alternative 4 would require the temporary use of 458.9 acres of Important Farmland, permanent conversion of 1,032.6 acres of Important Farmland and 147 acres of waste management lands, an estimated total annual reduction in crop revenues of $7.1 million and annual dairy production loss of $5.4 million, and an estimated reduction of 90 agricultural and dairy jobs.
Impact SOCIO #14: Construction Impacts on Property Taxes	Property tax revenues would be reduced by 0.004% overall because of property acquisitions. Other aspects of construction may result in reduction in property values that cannot be quantified because of increased noise, light, and glare.	Same as Alternative 1, except that property tax revenues would be reduced by 0.006% overall because of property acquisitions. Other aspects of construction may result in reduction in property values that cannot be quantified because of increased noise, light, and glare.	Same as Alternative 1, except that property tax revenues would be reduced by 0.004%. Also Alternative 3 would not be anticipated to experience a beneficial effect on property values in the area of the East Gilroy Station because additional transit-oriented development would not occur in this area.	Same as Alternative 1, except that property tax revenues would be reduced by 0.003%. Also property values would be less likely to be affected along Monterey Road in the Monterey Corridor Subsection because Monterey Road would not be narrowed.
Impact SOCIO #15: Construction Impacts on Sales Tax Revenues	An increase in sales tax revenues of $61.6 million is expected for Santa Clara, San Benito, and Merced Counties and the communities in the region as a result of construction of Alternative 1.	An increase in sales tax revenues of $52.8 million is expected for Santa Clara, San Benito, and Merced Counties and the communities in the region as a result of construction of Alternative 2.	An increase in sales tax revenues of $63.3 million is expected for the Santa Clara, San Benito, and Merced Counties and the communities in the region as a result of construction of Alternative 3.	An increase in sales tax revenues of $40.1 million is expected for the Santa Clara, San Benito, and Merced Counties and the communities in the region as a result of construction of Alternative 4.
Impact SOCIO #16: Temporary Impact on Private Recreational Waterfowl Hunting	Project construction would not affect the overall economic viability of waterfowl hunting activities in the GEA.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Station Planning, Land Use, and Development				
Alteration of Land Use Patterns				
Impact LU#1: Temporary Alteration of Land Use Patterns from Land Use Conversion or Introduction of Incompatible Land Uses	Construction of the project would temporarily convert 1,521.5 acres, but land use patterns would not be substantially altered.	Construction of the project would temporarily convert 1,807.2 (1,807.7)[3] acres, but land use patterns would not be substantially altered.	Construction of the project would temporarily convert 1,531.4 acres, but land use patterns would not be substantially altered.	Construction of the project would temporarily convert 1,109.7 acres, but land use patterns would not be substantially altered.
Impact LU#2: Temporary Alteration of Land Use Patterns from Increased Traffic, Noise, Air Quality Emissions, and Visual Changes	Seven precasting yards would be required as well as 20 additional miles of aerial profile. The project would provide continuous property access by maintaining traffic flow; managing fugitive dust emissions, noise, and vibration; and restoring construction staging areas to their original condition.	Alternative 2 would include 20 additional miles of embankment rather than aerial profile. Project features would be the same as Alternative 1.	Same as Alternative 1.	Alternative 4 would be constructed entirely within the existing rail corridor through downtown Gilroy. Four precasting yards would be required. Temporary indirect impacts on land use patterns would be less than under Alternatives 1 through 3.
Impact LU#3: Temporary and Permanent Alteration of Land Use Patterns from Roadway Closures and Modifications	Seventeen permanent road modifications and seven new grade separations. Road closures and modifications would not result in large-scale relocations leading to altered land use patterns.	Twenty-nine permanent road closures and 32 new grade separations. Similar to Alternative 1, although substantially more road closures and grade separations.	Seventeen permanent road closures and 10 new grade separations, similar to Alternative 1.	Fifteen permanent road closures and six new grade separations, similar to Alternative 1.
Impact LU#4: Permanent Alteration of Land Use Patterns from Land Use Conversion and Introduction of Incompatible Uses	Construction of Alternative 1 would result in the permanent conversion of 2,996.4 acres, but the project would improve connectivity to neighboring communities. For the majority of the alignment, Alternative 1 would not substantially alter land use patterns.	Construction of Alternative 2 would result in the permanent conversion of 3,303.8 (3,306.3)[3] acres but, with the same project features as under Alternative 1, would not substantially alter land use patterns.	Construction of Alternative 3 would result in the permanent conversion of 3,084.3 acres and introduce an incompatible use at the station site in east Gilroy, and with the same project features as Alternative 1, would substantially alter land use patterns.	Construction of Alternative 4 would result in the permanent conversion of 3,003.0 acres but, with the same project features as under Alternative 1, would not substantially alter land use patterns.
Inducement of Population Growth beyond Planned Levels				
Impact LU#6: Temporary Induced Population Growth	Population growth that might be induced by increased employment opportunities for construction would not be considered substantial or exceed planned levels locally or regionally. The increase in employment would be beneficial to the local economy.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Agricultural Farmlands				
Important Farmland				
Impact AG#1: Temporary Use of Important Farmland	Project construction would result in the temporary use of 617.6 acres of Important Farmland. IAMFs to require the Authority to provide advance written notice to agricultural property owners or leaseholders immediately adjacent to the disturbance limits for the project footprint (AG-IAMF#4) and to require the Authority to restore affected Important Farmland after construction (AG-IAMF#1) will minimize potential temporary impacts on Important Farmland and accordingly the alternative would not result in the permanent conversion of important farmland to nonagricultural use.	Project construction would result in the temporary use of 658.6 acres of Important Farmland. The same IAMFs would be incorporated into the project design as Alternative 1.	Project construction would result in the temporary use of 671.9 acres of Important Farmland. This would be the greatest impact among the alternatives. The same IAMFs would be incorporated into the project design as Alternative 1.	Project construction would result in the temporary use of 460.9 acres of Important Farmland. This would be the least impact among the alternatives. The same IAMFs would be incorporated into the project design as Alternative 1.
Impact AG#2: Permanent Conversion of Important Farmland to Nonagricultural Use	Project construction would result in permanent conversion of 1,035.5 acres of Important Farmland to nonagricultural use. The score for each county on Form NRCS-CPA-106 would be below the LESA threshold of 160.[4] No federal direction is required.	Project construction would result in permanent conversion of 1,181.3 acres of Important Farmland to nonagricultural use. The score for each county on Form NRCS-CPA-106 would be below the LESA threshold of 160.[4] No federal direction is required.	Project construction would result in permanent conversion of 1,192.5 acres of Important Farmland. This would be the greatest impact among the alternatives. The score for each county on Form NRCS-CPA-106 would be below the LESA threshold of 160.[4] No federal direction is required.	Project construction would result in permanent conversion of 1,032.6 acres of Important Farmland. This would be the least impact among the alternatives. The score for each county on Form NRCS-CPA-106 would be below the LESA threshold of 160.[4] No federal direction is required.
Impact AG#3: Permanent Creation of Remnant Parcels of Important Farmland	Project construction would result in permanent conversion of 162.9 acres of Important Farmland through the creation of remnant parcels. AG-IAMF#3 will minimize the impact on Important Farmland by providing for continued agricultural use on the maximum feasible amount of remnant parcels through the sale of remnant parcels to neighboring landowners for consolidation with adjacent farmland properties. However, permanent conversion would still result.	Project construction would result in permanent conversion of 244.3 acres of Important Farmland through the creation of remnant parcels. The same IAMFs would be incorporated into the project design as Alternative 1.	Project construction would result in permanent conversion of 252.8 acres of Important Farmland through the creation of remnant parcels. This would have the greatest impact among the alternatives. The same IAMFs would be incorporated into the project design as Alternative 1.	Project construction would result in permanent conversion of 147.0 acres of Important Farmland through the creation of remnant parcels. This would have the least impact among the alternatives. The same IAMFs would be incorporated into the project design as Alternative 1.
Impact AG#4: Temporary Disruption of Agricultural Infrastructure Serving Important Farmland	Project construction would temporarily disrupt 215 electrical lines and 20 pipelines or canals. PUE-IAMF#4 will involve coordination with service providers to minimize or avoid interruptions in service, PUE-IAMF#2 will involve installation of new facilities before disconnecting old facilities, and PUE-IAMF#3 will involve advance notification of service disruptions to customers to minimize the impacts on utilities and irrigation infrastructure TR-IAMF#2 will minimize traffic disruption with a temporary construction plan to require detours and signage, AG-IAMF#5 will provide for temporary livestock and equipment crossings, and AG-IAMF#4 will provide advance notification to adjacent agricultural property owners or leaseholders. These IAMFs will minimize potential temporary impacts on Important Farmland and the alternative would not result in permanent conversion of Important Farmland to nonagricultural use as a result of disruption of utilities, irrigation infrastructure, or roads. Project construction could potentially temporarily disrupt agricultural drainage infrastructure. This disruption would result in conversion of Important Farmland to nonagricultural use.	Project construction would temporarily disrupt 231 electrical lines and 20 pipelines or canals. The same IAMFs would be incorporated into the project design as Alternative 1.	Project construction would temporarily disrupt 210 electrical lines and 17 pipelines or canals. The same IAMFs would be incorporated into the project design as Alternative 1.	Project construction would temporarily disrupt 207 electrical lines, and 18 pipelines or canals. The same IAMFs would be incorporated into the project design as Alternative 1.

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact AG#5: Permanent Disruption of Agricultural Infrastructure Serving Important Farmland	Project construction would result in the permanent closure of 10 roads and 7 permanent farm road modifications. PUE-IAMF#2 will provide that any new irrigation facilities would be installed and operational before existing facilities would be disconnected. AG-IAMF#6 will provide for permanent equipment crossings, minimizing the impact of road closures on agricultural operations. TR-IAMF#2 will provide for road crossings in rural areas every 1 to 2 miles. These IAMFs will minimize the impact of agricultural infrastructure disruption on Important Farmland as a result of disruption of utilities, irrigation infrastructure, or roads. Project construction could potentially permanently disrupt agricultural drainage infrastructure. This disruption would result in conversion of Important Farmland to nonagricultural use. From Station 3148+60 to Station 3154 (near Casa de Fruta), embankment could interfere with operation of parcel-specific irrigation infrastructure, potentially resulting in conversion of Important Farmland to nonagricultural use.	Project construction would result in the permanent closure of 16 roads and 8 permanent farm road modifications. The same IAMFs would be incorporated into the project design as Alternative 1.	Project construction would result in the permanent closure of 12 roads and 31 permanent farm road modifications. This would be the greatest impact among the alternatives. The same IAMFs would be incorporated into the project design as Alternative 1.	Project construction would result in the permanent closure of 12 roads and 3 permanent farm road modifications. This would be the least impact among the alternatives. The same IAMFs would be incorporated into the project design as Alternative 1.
Impact AG#6: Permanent Interference with Aerial Spraying Activities for Important Farmland	Project construction would involve building widely spaced towers that would not result in changes in aerial spraying patterns leading to the conversion of Important Farmland to nonagricultural use.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact AG#7: Permanent Induced Wind Interference with Agricultural Activities on Important Farmland	The wind at the edge of the HSR right-of-way during project operations would not be strong enough to interfere with agricultural activities such as insect pollination or aerial pesticide application, and would not result in indirect permanent conversion of Important Farmland to nonagricultural use.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Farmland Protected by Williamson Act Contracts				
Impact AG#8: Reduction of Important Farmland Protected by Williamson Act Contracts and Agricultural Conservation Easements	The project would not affect implementation of the Williamson Act. While it would affect Important Farmland within agricultural conservation easements, this effect has already been accounted for under Impact AG#2 and Impact AG#3.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Parks, Recreation, and Open Space				
Parks, Recreation, and Open Space Resources				
Impact PK#1: Temporary Changes from Noise, Vibration, and Construction Emissions on Use and User Experience of Parks, Recreational Facilities, and Open Space Resources	The use and user experience at 33 resources would be affected by noise, vibration, and air emissions.	The use and user experience of 42 resources would be affected by noise, vibration, and air emissions. Use of the gardens at Villa Mira Monte and the amphitheater at the Morgan Hill Community and Cultural Center would be impaired by construction noise for approximately 1 year during two phases of construction (concrete pour/aerial structure and track installation) and by vibration impacts.	The use and user experience at 35 resources would be affected by noise, vibration, and air emissions.	The use and user experience at 37 resources would be affected by noise, vibration, and air emissions. Use of the gardens at Villa Mira Monte and the amphitheater at the Morgan Hill Community and Cultural Center would be impaired by construction noise for approximately 6 months during one phase of construction (track installation) and by vibration impacts.
Impact PK#2: Temporary Changes to Access or Use of Parks	Access to 10 resources would be limited during construction because of TCEs and placement of equipment.	Access to 15 resources would be limited during construction because of TCEs and placement of equipment.	Access to 13 resources would be limited during construction because of TCEs and placement of equipment.	Access to five resources would be limited during construction because of TCEs and placement of equipment.
Impact PK#3: Temporary Visual Changes That Could Create a Perceived Barrier to Access or Continued Use of Parks, Recreation, and Open Space	Depending on location, viewers could see staging areas, worker parking, and equipment and materials storage areas. Construction of the project would not create a perceived barrier to use.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact PK#4: Permanent Changes Affecting Access to or Circulation in Parks, Recreational Facilities, and Open Space Resources	There would be permanent changes affecting access or circulation at Highway 87 Bikeway North, Coyote Creek Trail, and Fisher Creek Trail (Planned).	Same as Alternative 1.	Same as Alternative 1.	There would be permanent changes affecting access or circulation at Highway 87 Bikeway North and Fisher Creek Trail (Planned).
Impact PK#5: Permanent Visual Changes That Could Create a Perceived Barrier to Access or Continued Use of Parks, Recreation, and Open Space Resources	There would be no permanent visual changes that would create a perceived barrier to access or use.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact PK#6: Permanent Acquisition of Parks, Recreation, and Open Space Resources	Construction would result in permanent acquisition of portions of seven resources. All parks and trails will remain useable with incorporation of project features and mitigation measures.	Construction would result in permanent acquisition of portions of 10 resources. All parks and trails will remain useable with incorporation of project features and mitigation measures.	Construction would result in permanent acquisition of portions of nine resources. All parks and trails will remain useable with incorporation of project features and mitigation measures.	Construction would result in permanent acquisition of portions of four resources. All parks and trails will remain useable with incorporation of project features and mitigation measures.
School District Play Areas				
Impact PK#9: Temporary Changes from Exposure to Noise, Vibration, and Construction Emissions on Use and User Experience of School District Play Areas	Construction would result in temporary changes from noise, vibration, and emissions on resource use and user experience.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact PK#10: Temporary Changes to Access or Use of School District Play Areas	Construction would result in temporary changes to access or use.	Same as Alternative 1.	Same as Alternative 1.	No changes in access would occur.
Impact PK#11: Temporary Visual Changes That Could Create a Perceived Barrier to Access or Continued Use of School Play Areas	Depending on location, viewers could see staging areas, worker parking, and equipment and materials storage areas. Construction of the project would not create a perceived barrier to use.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact PK#12: Permanent Changes Affecting Access to School District Play Areas	Construction would not result in permanent changes in access to or circulation at any school district play areas.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact PK#13: Permanent Visual Changes That Could Create a Perceived Barrier to Access or Continued Use of School Play Areas	There would be no permanent visual changes that would create a perceived barrier to access or use.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact PK#14: Permanent Acquisition of School District Play Areas	Construction would result in the partial acquisition of South Valley Middle School (8 percent of the total play area).	Construction would result in the partial acquisition of San Martin/Gwinn Elementary School (1% percent of the total play area) and South Valley Middle School (22 percent of the total play area).	No school district play areas would be affected.	No school district play areas would be affected.
Aesthetics and Visual Quality				
Visual Quality				
Impact AVQ#1: Temporary Direct Impacts on Visual Quality and Scenic Vistas	Construction activities would temporarily degrade visual quality as construction proceeds along the length of the HSR alignment, including the use of precast yards for construction of 45.4 miles of viaduct, resulting in the greatest impact.	Construction activities would temporarily degrade visual quality as construction proceeds along the length of the HSR alignment, including the use of precast yards for construction of 20.9 miles of viaduct.	Construction activities would temporarily degrade visual quality as construction proceeds along the length of the HSR alignment, including the use of precast yards for construction of 43.2 miles of viaduct, resulting in a greater impact than Alternatives 2 and 4.	Construction activities would temporarily degrade visual quality as construction proceeds along the length of the HSR alignment, resulting in the least impact.
Impact AVQ#2: Permanent Direct Impacts on Visual Quality—Santa Clara Landscape Unit	The alignment would be at grade, and the additional rail infrastructure would be within and adjacent to existing railway facilities, such that the baseline visual quality (moderately high) of the area would not be affected, resulting in the least impact.	The construction of an elevated viaduct and other structures would change the baseline visual character and block or change locally important views for residents, such that the baseline visual quality of the landscape unit would be reduced from moderately high to moderate.	Same as Alternative 2.	Same as Alternative 1.

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact AVQ#3: Permanent Direct Impacts on Visual Quality—Diridon Station Landscape Unit	HSR infrastructure, including aerial structures rising up to 60 feet, would introduce permanent changes to the visual character of the Diridon Landscape Unit, reducing visual quality from moderate to moderately low, predominantly affecting travelers and commercial viewer groups (moderate sensitivity).	Same as Alternative 1	Same as Alternative 1.	Track shifts and platform modifications to allow for HSR service to be blended with Caltrain service would not change the visual quality of the Diridon Landscape Unit, resulting in the least impact.
Impact AVQ#4: Permanent Direct Impacts on Visual Quality—San Jose Station Approach Landscape Unit	HSR infrastructure, including a viaduct rising up to 60 feet, would introduce permanent changes to the existing visual character of the San Jose Station Approach Landscape Unit (moderately high visual quality) which includes the Gardner neighborhood (moderately high sensitivity), by adding a view of transportation infrastructure, such that the existing visual quality of the landscape unit would be degraded.	Same as Alternative 1.	Same as Alternative 1.	Track shifts and reconstruction or modification of existing grade separations to allow addition of a third track to permit HSR service to be blended with Caltrain service would not change the visual quality of the San Jose Station Approach Landscape Unit, resulting in the least impact.
Impact AVQ#5: Permanent Direct Impacts on Visual Quality—Communications Hill Landscape Unit	The expansion of railway infrastructure and elimination of vegetation between Communications Hill Park and the rail right-of-way in the Communications Hill Landscape Unit (moderately high visual quality) would introduce permanent changes for the residential and recreational viewers (high sensitivity) by visually encroaching upon the park, degrading visual quality at KVP 9. For the entire landscape unit, the effect would be neutral because of few sensitive viewers.	Same as Alternative 1.	Same as Alternative 1.	Track shifts to allow addition of a third track to permit HSR service to be blended with Caltrain service would not change the visual quality of the Communications Hill Landscape Unit, resulting in the least impact.
Impact AVQ#6: Permanent Direct Impacts on Visual Quality—Monterey Highway San Jose Landscape Unit	Construction of the HSR viaduct would be visible over existing noise barriers and landscaping that currently shield residential views to Monterey Road and the UPRR/Caltrain tracks and would introduce permanent changes for the residential and recreational (high sensitivity) viewers, resulting in the greatest impact.	Reconstruction of Monterey Road and associated landscaping would improve visual quality from moderate to high in an area with travelers with moderate sensitivity.	Same as Alternative 1.	Track shifts and modifications to the Capitol and Blossom Hill Caltrain Stations to allow for HSR service to be blended with Caltrain service would not change the visual quality of the Monterey Highway San Jose Landscape Unit, resulting in the least impact.
Impact AVQ#7: Permanent Direct Impacts on Visual Quality—Coyote Valley Landscape Unit	Alternative 1 would run on an elevated structure in the median of Monterey Road. Construction of the viaduct would alter the existing visual character of agricultural landscape, degrading the visual quality of the landscape unit from moderately high to moderate for moderately high viewers, resulting in the greatest impact.	Alternative 2 would run at grade in the right-of-way of Monterey Road and require the removal of Keesling's Shade Trees. Design improvements and landscaping would reduce visual conflicts and maintain the existing visual quality of the landscape, resulting in no impact on visual quality.	Same as Alternative 1.	Track shifts and modifications to allow for HSR service to be blended with Caltrain service would not change the visual quality of the Coyote Valley Landscape Unit, resulting in a lesser impact than Alternatives 1 and 3.
Impact AVQ#8: Permanent Direct Impacts on Visual Quality—US 101 Landscape Unit	Alternative 1 would extend 4.7 miles through the US 101 Landscape Unit (moderate visual quality) predominantly affecting views from travelers along US 101 (moderate viewer sensitivity). Alternative 1 would affect fewer viewers than Alternative 3 because of its shorter length.	Does not pass through the landscape unit; therefore, there would be no impact.	Alternative 3 would extend 5.7 miles through the US 101 Landscape Unit (moderate visual quality), predominantly affecting views from travelers along US 101 (moderate viewer sensitivity). Alternative 3 would affect more viewers because of its longer length, resulting in the greatest impact.	Same as Alternative 2.
Impact AVQ#9: Permanent Direct Impacts on Visual Quality—Morgan Hill–San Martin Landscape Unit	Construction of a viaduct from US 101 to the UPRR/Caltrain corridor south of San Martin would contrast in scale and material with the existing moderate visual character of residential neighborhoods and agricultural land, degrading the visual quality of the landscape unit to moderately low as viewed by moderately sensitive viewers, resulting in a greater impact than Alternatives 3 or 4.	The addition of at-grade tracks along the UPRR/Caltrain corridor would not block distant views, but views would still be restricted across the railway corridor because of grade-separated road over- and undercrossings. In contrast to Alternatives 1 and 3, the at-grade tracks and associated infrastructure would not dominate the local visual environment, degrading the visual quality of the landscape unit from moderate to moderately low as viewed by moderately sensitive viewers. However, impacts would occur along the entire length of the railway corridor, resulting in the greatest impact.	Same as Alternative 1, except Alternative 3 would leave the UPRR/Caltrain corridor for the US 101 corridor south of San Martin on an aerial structure. The deviation in alignment from that described for Alternative 1 would not produce any unique impacts.	Track shifts and modifications to the Morgan Hill and San Martin Caltrain Stations to allow for HSR service to be blended with Caltrain service would increase the visual quality of the Morgan Hill–San Martin Landscape Unit, resulting in the least impact.

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact AVQ#10: Permanent Direct Impacts on Visual Quality—Downtown Gilroy Landscape Unit	Primarily on viaduct up to 50 feet above grade along the UPRR corridor, Alternative 1 would substantially contrast with the established character of residential areas and block views of surrounding hills. Construction of an elevated station at Gilroy would conflict with the historic Gilroy Caltrain Station and Gilroy City Hall, degrading the visual quality of the landscape unit from moderate to moderately low as viewed by viewers with moderately low sensitivity. Because it would use the highest viaduct, it would result in the greatest impacts.	Following the same alignment as Alternative 1, Alternative 2 would run primarily on embankment up to 20 feet above grade, partially blocking views and introducing changes to commercial and residential views. Matching the height of surrounding buildings, the scale of the embankment would not contrast with the existing landscape. However, the elevated HSR station platforms would visually dominate the historic Gilroy Caltrain Station and Gilroy City Hall, degrading the visual quality of the landscape unit from moderate to moderately low as viewed by viewers with moderately low sensitivity, resulting in greater impacts than Alternatives 3 or 4.	Alternative 3 would not pass through the Downtown Gilroy Landscape Unit, resulting in no impact.	Track shifts and modifications to the Gilroy Caltrain Station to allow for HSR service to be blended with Caltrain service would not change the visual quality of the Downtown Gilroy Landscape Unit.
Impact AVQ 11: Permanent Direct Impacts on Visual Quality—Pajaro–San Felipe Landscape Unit	Viaducts to carry the HSR across the Pajaro River, Soap Lake floodplain, and intersecting roadways and embankments connecting the viaducts would introduce views of large-scale infrastructure to the agricultural setting and limit distant views. The South Gilroy MOWF would introduce an industrial use into an agricultural area. These actions would degrade the visual quality of the landscape unit, resulting in the least impact.	Same as Alternative 1.	On viaduct and embankment, Alternative 3 would contrast with the visual setting of existing agricultural areas. The East Gilroy Station and MOWF would contrast with the established character of residential areas, schools, and historic buildings in Old Gilroy and disrupt the existing agricultural setting, degrading visual quality in the landscape unit, resulting in the greatest impact.	Similar to Alternative 1 with the same impact on visual quality.
Impact AVQ#12: Permanent Direct Impacts on Visual Quality—Pacheco Pass Landscape Unit	Viaducts rising up to 60 feet, along with other HSR infrastructure such as tunnel portals and terracing of hillsides, would contrast with the agricultural and open space setting and have an impact on the visual quality of travelers' views, degrading the visual quality of the landscape unit from high to moderately high as viewed by travelers with moderately high sensitivity.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact AVQ#13: Permanent Direct Impacts on Visual Quality—San Luis Landscape Unit	Construction of HSR tunnels would not be visible to viewers, resulting in no change to visual quality in the landscape unit.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact AVQ#14: Permanent Direct Impacts on Visual Quality—Romero Landscape Unit	Construction of the HSR viaduct would introduce modern infrastructure into a natural setting but would not degrade visual quality in the landscape unit.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact AVQ#15: Permanent Direct Impacts on Visual Quality—Henry Miller Landscape Unit	Construction of the HSR viaduct would introduce modern infrastructure into a natural setting, but it would not lower the visual quality in the landscape unit.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact AVQ#16: Indirect Impacts on Visual Quality from HSR Stations	Land use development around HSR stations in San Jose and downtown Gilroy would be expected to maintain the existing visual character of the community through implementation of sound design principles in the Authority's "zone of responsibility" around each station, resulting in the least impact.	Same as Alternative 1.	Same as Alternative 1 for the San Jose Diridon Station. Even with application of sound design principles in the "zone of responsibility," land use development around the East Gilroy Station would alter the land use patterns in an agricultural area, thereby degrading the existing visual quality of the area, resulting in no impact on visual quality in the Diridon Station Landscape Unit but in the greatest impact in the Pajaro-San Felipe Landscape Unit.	Same as Alternative 1.
State Scenic Highways				
Impact AVQ#17: Impacts on State Scenic Highways	Where all project alternatives cross I-5, the HSR embankment and grade-separation would be similar to existing highway infrastructure and would not affect the visual quality of the highway. The project would not be visible from SR 152 and would not degrade visual quality in the landscape unit.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Light and Glare				
Impact AVQ#18: Temporary Direct Impacts on Nighttime Light Levels	Lighting for tunnel portal construction sites in the Pajaro-San Felipe, Pacheco Creek Valley, and Romero Valley Landscape Units would create a new source of substantial light for up to 5 years, reducing visual quality for the duration of construction.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact AVQ#19: Permanent Direct Impacts on Nighttime Light Levels at Fixed Locations	Alternative 1 would cause permanent visual impacts from the increase in lighting levels at HSR facilities in rural agricultural settings where existing nighttime light levels are low, including an MOWF south of Gilroy and an MOWS in the San Joaquin Valley, resulting in the least impact.	Same as Alternative 1.	Same as Alternative 1, except an HSR station and an MOWF would be built east of Gilroy and would increase the fixed sources of light in an existing agricultural area with low nighttime light levels, resulting in the greatest impact	Same as Alternative 1.
Impact AVQ#20: Permanent Direct Impacts on Nighttime Light Levels from Trains	Spillover light levels in residential areas would affect highly sensitive residential viewers, especially from trains passing on 45.4 miles of viaducts, degrading visual quality where sensitive viewers are present, resulting in the greatest impact.	Light spillover from viaducts would occur along 20.9 miles of elevated track, degrading visual quality where sensitive viewers are present, resulting in lesser impacts than Alternatives 1 and 3	Light spillover from viaducts would occur along 43.2 miles of elevated track, degrading visual quality where sensitive viewers are present, resulting in a greater impact than Alternatives 2 and 4.	Light from HSR trains in urbanized areas would be similar to existing light from passenger and freights trains, degrading visual quality where sensitive viewers are present, resulting in the least impact.
Cultural Resources				
Archeological Resources				
Impact CUL#1: Permanent Disturbance of Unknown Archaeological Sites	Possible as-yet recorded resources damaged or destroyed. Because of limited access to private lands within the APE, all alternatives have the potential to damage previously unidentified archaeological sites prior to construction or buried sites found during construction. Alternative 1 has the third largest amount of archaeologically sensitive acres including land in the existing right-of-way and new acquisition areas: General Sensitivity: 622 acres Buried Sensitivity: 3,251 acres	Possible as-yet recorded resources damaged or destroyed. Because of limited access to private lands within the APE, all alternatives have the potential to damage previously unidentified archaeological sites prior to construction or buried sites found during construction. Alternative 2 has the largest amount of archaeologically sensitive acres including land in the existing right-of-way and new acquisition areas: General Sensitivity: 683 acres Buried Sensitivity: 3,828 acres	Possible as-yet recorded resources damaged or destroyed. Because of limited access to private lands within the APE, all alternatives have the potential to damage previously unidentified archaeological sites prior to construction or buried sites found during construction. Alternative 3 has the second largest amount of archaeologically sensitive acres including land in the existing right-of-way and new acquisition areas: General Sensitivity: 625 acres Buried Sensitivity: 3,386 acres	Possible as-yet recorded resources damaged or destroyed. Because of limited access to private lands within the APE, all alternatives have the potential to damage previously unidentified archaeological sites prior to construction or buried sites found during construction. Alternative 4 has the fewest archaeologically sensitive acres including land in the existing right-of-way and new acquisition areas: General Sensitivity: 568 acres Buried Sensitivity: 2,713 acres
Impact CUL#2: Permanent Disturbance of Known Archaeological Sites	25 archaeological sites adversely affected. Of these, 10 completely or partially encompassed; 15 narrow rights-of-way or sliver acquisitions.	31 archaeological sites adversely affected. Of these, 13 completely or partially encompassed; 18 narrow rights-of-way or sliver acquisitions.	28 archaeological sites adversely affected. Of these, 12 completely or partially encompassed; 16 narrow rights-of-way or sliver acquisitions	25 archaeological sites adversely affected. Of these, 10 completely or partially encompassed; 15 narrow rights-of-way or sliver acquisitions
Impact CUL#3: Temporary Public Access and Disturbance of Archaeological Resources	None anticipated.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.

Resource Category	Construction Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Historic Built Resources				
Impact CUL#4: Permanent Demolition, Destruction, Relocation, or Alteration of Built Resources or Setting	7 built resources adversely affected. These include: Resource ID 0497; Resource ID 0522; Resource ID 0585; Resource ID 3001; Resource ID 3458; Resource ID 4310; Resource ID 4317 Of these, 5 built resources would be demolished, relocated, or destroyed. In most cases demolition or destruction would result from introduction of HSR right-of-way or roadway right-of-way; 1 built resource would experience compromised integrity due to the loss of character-defining features; and the setting of 1 resource would be altered by introduction of HSR right-of-way, which would change the historic context.	11 built resources adversely affected. These include: Resource ID 0141; Resource ID 0497; Resource ID 0522; Resource ID 0585; Resource ID 1863; Resource ID 1909; Resource ID 3001; Resource ID 3402; Resource ID 3458; Resource ID 4310; Resource ID 4317 Of these, 7 built resources would be demolished or destroyed. In most cases demolition would result from introduction of HSR right-of-way or roadway right-of-way; 2 built resources would experience compromised integrity due to the loss of character-defining features; and the setting of 2 resources would be altered by introduction of HSR right-of-way, which would change the historic context.	7 built resources adversely affected. These include: Resource ID 0141; Resource ID 0497; Resource ID 0522; Resource ID 0585; Resource ID 3001; Resource ID 4310; Resource ID 4317 Of these, 4 built resources would be demolished. In most cases demolition would result from introduction of HSR right-of-way or roadway right-of-way; 1 built resource would experience compromised integrity due to the loss of character-defining features; and the setting of 2 resources would be altered by introduction of HSR right-of-way, which would change the historic context.	5 built resources adversely affected. These include: Resource ID 0497; Resource ID 2127; Resource ID 3458; Resource ID 4310; Resource ID 4317 Of these, 3 built resources would be demolished. In most cases demolition would result from introduction of HSR right-of-way or roadway right-of-way; 1 built resource would experience compromised integrity due to the loss of character-defining features; and the setting of 1 resource would be altered by introduction of HSR right-of-way, which would change the historic context.
Impact CUL#5: Temporary Noise and Vibration Impacts on Built Resources Caused by Construction Activities	0 built resources adversely affected.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.

[1] The analysis assumed that project construction would take place from 2018 to 2026. As construction is expected to take place later than these dates, the construction emissions estimates are conservative, as future emissions rates will be lower due to the implementation of cleaner and newer equipment.
[2] For Section 3.7, permanent conversion and degradation impacts include both temporary and permanent impacts. Refer to Section 3.7 for more information on the ecological impacts of the project on aquatic resources and associated species.
[3] Alternative 2 has two design variants: Skyway Drive Variant A is presented first, with Skyway Drive Variant B shown in parentheses.
[4] LESA scores are not aggregated over an entire alternative, but instead are calculated for the alternative within each county.

ACE = Altamont Corridor Express
ACM = asbestos-containing material
ADL = aerially deposited lead
ALAN = artificial light at night
APE = area of potential effects
AREMA = American Railway Engineering and Maintenance-of-Way Association
BAAQMD = Bay Area Air Quality Management District
BMP = best management practice
Btu = British thermal unit
C.F.R. = Code of Federal Regulations
CAAQS = California Ambient Air Quality Standards
Caltrans = California Department of Transportation
CBC = California Building Code
CCC = central California coast
CESA = California Endangered Species Act
CGP = construction general permit
CMP = construction management plan
CO = carbon monoxide
CO_2e = carbon dioxide equivalent
CTP = construction transportation plan
dBA = A-weighted decibel
DDV = Diridon design variant
DPM = diesel particulate matter
EFH = essential fish habitat
EMF = electromagnetic frequency
EMI = electromagnetic interference
FESA = federal Endangered Species Act
FHWA = Federal Highway Administration
GEA = Grasslands Ecological Area
GHG = greenhouse gas
HMBP = hazardous materials business plan
HSR = high-speed rail
IAMF = impact avoidance and minimization measure
IBA = Important Bird Area
kV = kilovolt
KVP = key viewpoint
LBP = lead-based paint
LESA = land evaluation and site assessment
LOS = level of service
mgd = million gallons per day
MOWS = maintenance of way siding
MOWF = maintenance of way facility
MSAT = mobile source air toxics
NAAQS = National Ambient Air Quality Standards
NCCAB = North Central Coast Air Basin
NO_2 = nitrogen dioxide
NOA = naturally occurring asbestos
NO_x = nitrogen oxide
OSHA = Occupational Health and Safety Administration
PCB = polychlorinated biphenyl
PEC = potential environmental concern
PG&E = Pacific Gas and Electric Company
PM_{10} = particulate matter less than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter
RSA = resource study area
RWQCB = Regional Water Quality Control Board
SCCC = south central California coast
SCRWA = South County Regional Wastewater Authority
SCVHP = Santa Clara Valley Habitat Plan
SFBAAB = San Francisco Bay Area Air Basin
SIL = significant impact levels
SJVAB = San Joaquin Valley Air Basin
SO_2 = sulfur dioxide
SSMP = safety and security management plan
SWPPP = stormwater pollution prevention plan
TCE = temporary conservation easement
TDV = tunnel design variant
TPSS = traction power substation
UPRR = Union Pacific Railroad
US = U.S. Highway
VMT = vehicle miles traveled
VOC = volatile organic compounds
WCA = wildlife corridor assessment
WWTP = wastewater treatment plant

Table S-4 Comparison of Operations Impacts by Alternative

Resource Category	Operations Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Transportation				
Roadways, Freeways, and Intersections				
Impact TR#6: Continuous Permanent Congestion/Delay Consequences on Freeway Operations	A lane reduction along Monterey Road would affect two freeway segments along US 101 in southern San Jose from congestion.	Same as Alternative 1	Same as Alternative 1	No lane reduction along Monterey Road. Less traffic would shift to US 101 than under the other project alternatives and no freeway segments would be affected.
Impact TR#7: Permanent Continuous Congestion/Delay Consequences on Intersection Operations	Increased project extent traffic and changes to the roadway network would affect 46 intersections operating at LOS E or F in 2029 and 49 intersections in 2040 in the San Jose Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections. With the proposed mitigation, this will be reduced to 23 intersections operating at LOS E or F in 2040 in the San Jose Diridon Station Approach and Monterey Corridor Subsections.	Increased project extent traffic and changes to the roadway network would affect 49 intersections operating at LOS E or F in 2029 and 55 intersections in 2040, resulting in the most intersection operations effects of the four alternatives. With the proposed mitigation, this will be reduced to 24 intersections operating at LOS E or F in 2040 in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections.	Increased project extent traffic and changes to the roadway network would affect 41 intersections operating at LOS E or F in 2029 and 44 intersections in 2040. With the proposed mitigation, this will be reduced to 23 intersections operating at LOS E or F in 2040 in the San Jose Diridon Station Approach and Monterey Corridor Subsections.	Increased project extent traffic and changes to the roadway network would affect 27 intersections operating at LOS E or F in 2029 and 32 intersections in 2040 in the San Jose Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections. With the proposed mitigation, this will be reduced to 22 intersections operating at LOS E or F in 2040 in San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections.
Parking				
Impact TR#9: Permanent Effects Related to Parking	No permanent loss of parking would occur related to the San Jose Diridon Station or Downtown Gilroy Station. Parking demands related to the San Jose Diridon Station and SAP Center can be met by existing facilities, project facilities, and the offsetting effects of increased transit service. Projected parking demands would be met by project parking facilities at the Downtown Gilroy Station.	Same as Alternative 1	Same as Alternative 1 for San Jose Diridon Station and SAP Center. For East Gilroy Station, all parking demands would be met by project parking facilities.	Permanent displacement of parking spaces near San Jose Diridon Station/SAP Center would also be replaced on a 1:1 basis.
Transit				
Impact TR#13: Continuous Permanent Impacts on Bus Services	10 high-frequency bus routes in the San Jose Diridon Station area, along Monterey Road and in the Downtown Gilroy Station area would be delayed because of project-related trips and roadway network changes.	Same as Alternative 1	10 high-frequency bus routes in the San Jose Diridon Station area and along Monterey Road would be delayed because of project-related trips and roadway network changes.	10 high-frequency bus routes in the San Jose Diridon Station area, along Monterey Road and in the Downtown Gilroy Station area would be delayed because of project-related trips and roadway network changes. This alternative would have the most impacts because of additional delays on at-grade crossings.
Impact TR#14: Continuous Permanent Impacts on Passenger Rail and Bus Access	Passenger rail and bus access will be accommodated by project design and project features. The project would not affect the performance of these services.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact TR#15: Continuous Permanent Impacts on Transit Ridership	Transit ridership would increase but would not hinder service by other transit providers or be inconsistent with transit plans and policies.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact TR#16: Continuous Permanent Impacts on Passenger Rail System Capacity	Caltrain average service times would increase slightly from the blending of service with HSR between Scott Boulevard and I-880, but a regular interval schedule would be maintained. The project would not materially decrease the performance of passenger rail services.	HSR would only operate on dedicated tracks and would not affect other passenger rail service capacity.	Same as Alternative 2	Same as Alternative 1 for blending with Caltrain north of Diridon. Blending service with Caltrain south of Diridon would not impair existing capacity.
Nonmotorized Travel				
Impact TR#19: Continuous Permanent Impacts on Pedestrian and Bicycle Access	Operations would introduce nonmotorized trips around station areas, but the project would be designed to maintain or enhance pedestrian and bicycle access, providing safe and accessible facilities.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Resource Category	Operations Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Freight Rail Service				
Impact TR#21: Continuous Permanent Impacts on Freight Rail Capacity	Shared track with freight between Scott Boulevard and CP Coast would result in disruptions to freight service and would result in temporal displacement but would not likely divert freight rail service to other modes.	This alternative would not include any shared track and would have no impact on freight service because of sharing of track.	Same as Alternative 2	Same as Alternative 1 for shared track with freight between Scott Blvd. and CP Coast. Freight would have separate track south of CP Coast and capacity would be maintained
Impact TR#22: Continuous Permanent Impacts on Freight Rail Operations	The project design and the HSR OCS installation would accommodate required freight height clearances where tracks are shared between CP Coast and Scott Boulevard	The project would not include any shared tracks with freight and thus would have no impacts related to the OCS and freight heights.	Same as Alternative 2	Same as Alternative 1
Noise and Vibration				
Noise[1]				
Impact NV#2: Intermittent Permanent Exposure of Sensitive Receptors to Noise from Train Operations	Permanent noise impacts from 2029 Plus Project conditions: ▪ 310 (313) moderate noise impacts ▪ 47 (51) severe noise impacts Permanent noise impacts from 2040 Plus Project conditions: ▪ 1,200 (1,195) moderate noise impacts ▪ 337 (347) severe noise impacts	Permanent noise impacts from 2029 Plus Project conditions: ▪ 599 (601) moderate noise impacts ▪ 38 (43) severe noise impacts Permanent noise impacts from 2040 Plus Project: ▪ 1,844 (1,838) moderate noise impacts ▪ 755 (766) severe noise impacts	Permanent noise impacts from 2029 Plus Project conditions: ▪ 227 (233) moderate noise impacts ▪ 34 (37) severe noise impacts Permanent noise impacts from 2040 Plus Project conditions: ▪ 834 (845) moderate noise impacts ▪ 222 (233) severe noise impacts	Permanent noise impacts from 2029 Plus Project conditions: ▪ 1,001 (1,004) moderate noise impacts ▪ 190 (197) severe noise impacts Permanent noise impacts from 2040 Plus Project conditions: ▪ 1,666 (1,658) moderate noise impacts ▪ 1,212 (1,224) severe noise impacts
Impact NV#3: Intermittent Permanent Exposure of Sensitive Receptors to Noise from HSR Passenger Station Parking	Noise contribution from parking facilities: ▪ 29 dBA L_{dn} at San Jose Diridon Station ▪ 40 dBA L_{dn} at the Downtown Gilroy Station This additional noise would be substantially lower than noise from HSR trains.	Same as Alternative 1	Noise contribution from parking facilities: ▪ 29 dBA L_{dn} at San Jose Diridon Station ▪ 28 dBA L_{dn} at the East Gilroy Station This additional noise would be substantially lower than noise from HSR trains.	Same as Alternative 1
Impact NV#4: Intermittent Permanent Exposure of Sensitive Receptors to Noise from HSR Maintenance Facilities	40 dBA L_{dn} contribution from train movements at the South Gilroy MOWF, which is substantially lower than the noise from operating HSR trains. No additional impact is projected.	Same as Alternative 1	47 dBA L_{dn} contribution from train movements at the East Gilroy MOWF, which is substantially lower than the noise from operating HSR trains. No additional impact is projected.	45 dBA L_{dn} contribution from train movements at the Alternative 4 South Gilroy MOWF, which is substantially lower than the noise from operating HSR trains. No additional impact is projected.
Impact NV#5: Intermittent Permanent Human Annoyance from Onset of Passing HSR Trains	Operations would not cause human annoyance from the startle effect of HSR train passbys within dedicated sections of the alignment because the threshold for sudden onset noise would occur within the right-of-way, which would be fenced to prohibit public access.	Same as Alternative 1	Same as Alternative 1	Operations would cause initial human annoyance from the startle effect of HSR train passbys at one location within 23 feet of the tracks in Morgan Hill. Effects south and east of Gilroy would be the same as Alternative 1.
Impact NV#6: Permanent Exposure of Sensitive Receptors to Vehicular Traffic Noise Increases	Roadway segments with an anticipated increase in traffic noise of ≥3 dB compared to existing conditions include: 2029 Plus Project conditions ▪ 4 segments near San Jose ▪ 2 segments along Monterey Road ▪ 1 segment near South Gilroy MOWF 2040 Plus Project conditions ▪ 5 segments near San Jose ▪ 6 segments along Monterey Road ▪ 1 segment near South Gilroy MOWF	Same as Alternative 1	Roadway segments with an anticipated increase in traffic noise of ≥3 dB compared to existing conditions include: 2029 Plus Project conditions ▪ 4 segments near San Jose ▪ 2 segments along Monterey Road 2040 Plus Project conditions ▪ 5 segments near San Jose ▪ 6 segments along Monterey Road 1 segment near East Gilroy MOWF	Roadway segments with an anticipated increase in traffic noise of ≥3 dB compared to existing conditions include: 2029 Plus Project conditions ▪ 3 segments near San Jose ▪ 3 segments along Monterey Road 2040 Plus Project conditions ▪ 4 segments near San Jose ▪ 6 segments along Monterey Road ▪ 1 segment near Downtown Gilroy Station ▪ 1 segment near South Gilroy MOWF
Impact NV#7: Intermittent Permanent Livestock Stress from Passing HSR Trains	Livestock within 30 feet from the edge of the HSR right-of-way would experience stress associated with exposure to noise levels above the recommended thresholds.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1. Also, livestock at two locations between San Jose and Gilroy within 65 feet of edge of HSR right-of-way would experience stress associated with exposure to noise levels from sounding of HSR horns.

Resource Category	Operations Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact NV#8: Permanent Exposure of Sensitive Receptors to Traction Power Facility Noise	The substation facilities would generate noise, but would not cause additional noise impacts beyond those from trains and horns.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Vibration				
Impact NV#10: Intermittent Permanent Exposure of Sensitive Receptors to Vibration from Operations	81 permanent vibration impacts (before mitigation); potential to reduce all or most of these impacts to below the threshold with mitigation.	143 permanent vibration impacts (before mitigation); potential to reduce all or most of these impacts to below the threshold with mitigation.	140 permanent vibration impacts (before mitigation); potential to reduce all or most of these impacts to below the threshold with mitigation.	1,203 permanent vibration impacts (before mitigation); potential to reduce all but 15 of these impacts to below the threshold with mitigation.
EMF and EMI				
Impact EMF/EMI#2: Permanent Human Exposure to EMFs	HSR operations would expose the general public and HSR employees and passengers to EMF inside and outside the HSR system. Inside the HSR system, EMF exposure levels would be below the most restrictive MPE limits. Outside the HSR system, EMF levels would not exceed the MPE thresholds for humans.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1 without the design variants. With the design variants, HSR train operations would generate slightly higher EMFs in the DDV and TDV areas than the alternatives without the DDV and TDV.
Impact EMF/EMI#3: Exposure of People with Implanted Medical Devices to EMFs	EMF levels generated inside traction power distribution and interconnection facilities and produced by emergency standby generators would be above the recommended limits for people with implanted medical devices. However, the public and workers with implanted medical devices would be restricted from accessing these facilities.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact EMF/EMI#4: Livestock and Poultry Exposure	Several studies documented that EMFs do not affect livestock or poultry productivity and would therefore not disrupt nearby agricultural activities. The three livestock and poultry operations in the RSA would be unaffected by operation of HSR trains.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact EMF/EMI#5: Interference with Sensitive Equipment	The RSA includes one facility with sensitive equipment; however, this facility would not be exposed to a magnetic shift greater than 2 mG.	The RSA includes three facilities with sensitive equipment, two of which would be exposed to a magnetic shift greater than 2 mG. The Authority would coordinate with third parties to identify sensitive equipment at the known receptors and, if necessary, identify appropriate mitigation, including performing tests to confirm equipment is not adversely affected.	The RSA includes two facilities with sensitive equipment, although neither would be exposed to a magnetic shift greater than 2 mG.	The RSA includes three facilities with sensitive equipment, two of which would be exposed to a magnetic shift greater than 2 mG. Coordination with third parties would be the same as under Alternative 2.
Impact EMF/EMI#6: EMI Effects on Schools	Dedicated frequency blocks for the HSR system and compliance with FCC regulations for all HSR equipment would not generate interference at the 12 schools within the Alternative 1 RSA.	Same as Alternative 1 for the 15 schools within the Alternative 2 RSA.	Same as Alternative 1 at the 11 schools within the Alternative 3 RSA.	Same as Alternative 1 at the 15 schools within the Alternative 4 RSA.
Impact EMF/EMI#7: Potential for Corrosion of Underground Pipelines and Cables and Adjoining Rail	The project would ground adjacent ungrounded linear metal structures or insulate metallic pipes to prevent current flow that could result in corrosion.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact EMF/EMI#8: Potential for Nuisance Shocks	The project would ground nearby ungrounded linear metal structures or insulate purposely electrified fences to prevent current flow.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact EMF/EMI#9: Effects on Adjacent Existing Rail Lines	There are 24.4 miles of parallel UPRR track susceptible to EMI impacts under Alternative 1. Project features include working with the engineering departments of adjacent parallel railroads to modify or upgrade their signal systems to prevent interference from HSR generated EMI.	There are 31.4 miles of parallel UPRR track susceptible to EMI impacts under Alternative 2. Project features would be the same as Alternative 1.	There are 16.4 miles of parallel UPRR track susceptible to EMI impacts under Alternative 3. Project features would be the same as Alternative 1.	There are 33.0 miles of parallel UPRR track susceptible to EMI impacts under Alternative 4. Project features would be the same as Alternative 1.

Resource Category	Operations Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact EMF/EMI#10: EMI Effects on Airports	The project alternatives would pass within 1,600 feet of San Jose International Airport and within 1,400 feet of San Martin Airport. HSR communications equipment would use dedicated frequency allocations, and relevant FAA engineering offices would be consulted during project design to confirm no interference.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Public Utilities and Energy				
Impact PUE#8: Continuous Permanent Impacts from Water Use	Operations would consume 224,200 gpd including operation of stations and maintenance facilities. Project features will effectively recycle and reuse water where possible and reduce overall consumption	Same as Alternative 1.	Operations would consume 223,800 gpd; East Gilroy Station water consumption would be approximately 500 gpd less than for the Downtown Gilroy Station. Other water consumption would be the same as Alternative 1.	Same as Alternative 1.
Impact PUE#9: Continuous Permanent Impacts from Wastewater Generation	Operations would generate 224,200 gpd of wastewater including the operation of stations and maintenance facilities. Wastewater would be disposed of properly and handled safely and would not exceed the available treatment capacity of local wastewater facilities.	Same as Alternative 1.	Operations would generate 223,800 gpd of wastewater; East Gilroy Station wastewater generation would be approximately 500 gpd less than for the Downtown Gilroy Station. Other wastewater generation would be the same as Alternative 1.	Same as Alternative 1.
Impact PUE#10: Continuous Permanent Impacts on Storm Drainage Facilities	The impact on stormwater drainage facilities would not require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.	Same as for Alternative 1	Same as for Alternative 1	Same as for Alternative 1
Impact PUE#11: Continuous Permanent Generation of Solid Waste and Hazardous Waste	Operations would generate approximately 2,560 cubic yards of solid waste annually. Solid waste and hazardous waste generation from operations would not exceed available disposal capacity.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Energy				
Impact PUE#13: Continuous Permanent Impacts from Energy Consumption during Operations	Operations would result in a net decrease in regional energy consumption of 6,335,230 MMBtu per year for medium ridership scenario and a net decrease of 6,709,070 MMBtu per year for the high ridership scenario in 2040. It would take approximately 7.6 years and 6.4 years of regional energy reductions to recoup the energy consumed during construction under the medium and high ridership scenarios, respectively.	Same as Alternative 1, with the exception of the payback period for construction energy, which would be 9.6 and 8.1 years under the medium and high ridership scenarios, respectively.	Same as Alternative 1, with the exception of the payback period for construction energy, which would be 8.0 and 6.8 years under the medium and high ridership scenarios, respectively.	Same as Alternative 1, with the exception of the payback period for construction energy, which would be 9.8 and 8.3 years under the medium and high ridership scenarios, respectively.
Biological Resources				
Special-Status Species				
Impact BIO#31: Intermittent Disturbance or Degradation of Habitat for Special-Status Plants during Operations	O&M activities may occasionally remove or disturb and degrade habitat for special-status plants in and adjacent to the project footprint. Annual WEAP training for maintenance personnel would minimize intermittent direct and indirect impacts on special-status plants under Alternative 1.	Impacts under Alternative 2 would be the same as under Alternative 1. There are no special-status plant species or activity types unique to one alternative; all have the same potential to result in intermittent direct and indirect impacts.	Impacts under Alternative 3 would be the same as under Alternative 1. There are no special-status plant species or activity types unique to one alternative; all have the same potential to result in intermittent direct and indirect impacts.	Impacts under Alternative 4 would be the same as under Alternative 1. There are no special-status plant species or activity types unique to one alternative; all have the same potential to result in intermittent direct and indirect impacts.

Resource Category	Operations Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact BIO#32: Intermittent Disturbance or Degradation of Habitat for Special-Status Wildlife during Operations	O&M activities may occasionally remove or disturb habitat for special-status wildlife in and adjacent to the project footprint. Impacts would the same as during construction but would occur where activities were conducted in or adjacent to modeled habitat. Annual environmental awareness training for maintenance personnel would minimize intermittent direct and indirect impacts on special-status wildlife under Alternative 1. Operations effects on special-status wildlife individuals (i.e., injury or mortality) are addressed in the discussion of effects on wildlife movement.	Impacts under Alternative 2 would be the same as under Alternative 1. There are no special-status wildlife species or activity types unique to one alternative; all have the same potential to result in intermittent direct and indirect impacts.	Impacts under Alternative 3 would be the same as under Alternative 1. There are no special-status wildlife species or activity types unique to one alternative; all have the same potential to result in intermittent direct and indirect impacts.	Impacts under Alternative 4 would be the same as those under Alternative 2. There are no special-status wildlife species or activity types unique to one alternative; all have the same potential to result in intermittent direct and indirect impacts.
Non-Special-Status Species				
Operations impacts on non-special-status species are addressed in the discussion of impacts on wildlife corridors.				
Special-Status Plant Communities				
Impact BIO#36: Intermittent Disturbance Degradation of Special-Status Plant Communities during Operations	O&M activities may occasionally remove or disturb and degrade special-status plant communities in and adjacent to the project footprint. Annual environmental awareness training for maintenance personnel would minimize intermittent direct and indirect impacts on special-status plant communities under all alternatives.			
Aquatic Resources				
Impact BIO#39: Intermittent Disturbance and Degradation of Aquatic Resources during Operations	O&M activities may occasionally remove or disturb and degrade aquatic resources in and adjacent to the project footprint. Annual environmental awareness training for maintenance personnel would minimize intermittent direct and indirect impacts on aquatic resources under all alternatives.			
Protected Trees				
Impact BIO#41: Disturbance of Trees Protected under Municipal Tree Ordinances during Operations	Ongoing vegetation management within the electrical safety zone could result in temporary impacts (i.e., occasional trimming). Any protected trees requiring removal would have been removed during construction. The Authority would require that all workers attend WEAP training about sensitive biological resources, including protected trees.			
Wildlife Corridors				
Impact BIO#44: Intermittent Nosie Disturbance of Wildlife Using Corridors during Operations	Noise from project operations could disturb and startle birds, particularly in the UPR and GEA IBAs, as well as cause varying degrees of hearing damage, leading to impacts on bioenergetic and reproductive success, as well as increasing the risk of train strike. Increasing the speeds from 200 mph to 220 mph in the Soap Lake area, as facilitated by the TDV, would increase the distances to the various effect thresholds for bird noise impacts. Additionally, noise would contribute to masking of acoustic information for terrestrial wildlife species, including mountain lion, Fresno kangaroo rat, and San Joaquin kit fox, leading to reduced habitat suitability.	Impacts under Alternative 2 would be the same as under Alternative 1 because both would have the same alignment and profile in the IBAs and within areas where terrestrial wildlife habitat is the most suitable.	Impacts under Alternative 3 would be greater than under the other alternatives because Alternative 3 would traverse more of the Soap Lake 10-year floodplain.	Impacts under Alternative 4 would be similar to but slightly greater than those under Alternatives 1 and 2 because of the presence of the MOWF at the edge of the Soap Lake 10-year floodplain.
Impact BIO#45: Intermittent Vibration Disturbance of Wildlife Using Corridors during Operations	Vibration associate with project operations are likely to have the greatest impacts on reptiles and amphibians because of their sensitivity to ground movement; however, vibration is not anticipated to result in substantial or long-lasting impacts. The impact would be most pronounced in at-grade portions of the alignment.	Impacts under Alternative 2 would be greater than those under Alternatives 1 and 3 because more of the alignment would be at grade.	Impacts under Alternative 3 would be similar to but greater than those under Alternative 1 because, while Alternative 3 would be on aerial structure in many of the same areas as Alternative 1, it would also cross more land conserved to protect movement corridors, including the Santa Cruz Mountains to Diablo Range wildlife linkage.	Impacts under Alternative 4 would be similar to those under Alternative 2 because of their similar use of at-grade and embankment profiles.

Resource Category	Operations Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact BIO#46: Intermittent Visual Disturbance of Wildlife Using Corridors during Operations	Moving trains could alter movement patterns of mammalian species due to visual stimuli associated with passing trains or maintenance activities. Moving trains may also cause visual cues, which cause animals to temporarily or permanently avoid an area. Moving trains could also increase stress and provoke flight in birds using nearby habitat, resulting in altered behavior and physiological consequences, as well as possible nest abandonment. The GEA and the Soap Lake 10-year floodplain are the two areas most susceptible to these impacts.	Impacts under Alternative 2 would be the same as those under Alternative 1.	Impacts under Alternative 3 would be greater than those under the other three alternatives because it would traverse more of the Soap Lake 10-year floodplain.	Impacts under Alternative 4 would be the same as those under Alternatives 1 and 2.
Impact BIO#47: Intermittent and Permanent Lighting Disturbance of Wildlife and Wildlife Using Corridors during Operations	Nighttime lighting, including light from passing trains, could disturb wildlife attempting to move through or across the alignment. The impact would be most marked in areas with low existing light levels, especially where the alignment would be at grade.	Impacts under Alternative 2 would be similar to those under Alternative 1. Although more of Alternative 2 would be at grade, these portions would be in existing transportation corridors where light levels are already high.	Impacts under Alternative 3 would be greater than under the other three alternatives because it would cross agricultural areas east of Gilroy at grade, would cross more of the Santa Cruz Mountains to Diablo Range wildlife linkage, and would include the East Gilroy MOWF and Station in areas that currently experience low light levels.	Impacts under Alternative 4 would be the same as those under Alternative 2.
Impact BIO#48: Mortality Resulting from Train Strike during Operations	Train strike is likeliest to cause mortality of terrestrial wildlife species along at-grade portions of the alignment. Alternative 1 would pose the lowest risk of train strike to terrestrial movement guilds because of the amount that would be on aerial structure. All profiles present risk of train strike to the aerial movement guild, although some focal groups are more susceptible to at-grade profiles, while others are more susceptible to elevated portions of the alignment.	Impacts under Alternative 2 would be greater than those under Alternative 1 because of the amount of the alignment at grade and on embankment.	Alternative 3 would present the greatest risk of train strike because, while much of it, like Alternative 1, would be on aerial structure, it would also cross through agricultural lands east of Gilroy at grade and would travel more closely to Coyote Creek than the other alternatives.	Impacts under Alternative 4 would be the same as those under Alternative 2.
Impact BIO#49: Injury and Mortality Resulting from Power Line Strike during Operations	Risk of power line strike would be ubiquitous along the alignment because of the consistent presence of electrical infrastructure. Alternative 1 could pose a greater risk to burrowing owls at San Jose International Airport, and would follow Coyote Creek for a greater distance than Alternatives 2 and 4.	Impacts under Alternative 2 would be similar to those under Alternative 1, except that there would be lesser risk to burrowing owls near the San Jose International Airport.	Impacts under Alternative 3 would be similar, although the distribution of the most severe risks would differ: Alternative 3 would cross less of the UPR IBA, although more of that distance would be in the Soap Lake 10-year floodplain, the area of most intensive bird use.	Impacts under Alternative 4 would be the same as those under Alternative 2.
Impact BIO#50: Mortality resulting from Entrapment in OCS Poles during Operations	The project is expected to avoid direct impacts from entrapment in OCS poles by design features that will preclude access to the poles.			
Conservation Areas				
Impact BIO#52: Introduction of Invasive Species or Contaminants into Conservation Areas during Operations	The project could have indirect impacts on conservation areas in all subsections. Routine inspections and maintenance of the HSR right-of-way could introduce contaminants from spills and invasive nonnative species to adjacent lands, degrading habitat for special-status species, special-status plant communities, aquatic resources, and wildlife corridors. All project alternatives would be similar in their potential to cause these impacts; however, Alternative 3 would result in the most permanent impacts and, by extrapolation, the most indirect impacts during the operations period.			
Hydrology and Water Resources				
Surface Water Hydrology				
Impact HYD#3: Impacts on Drainage Patterns and Stormwater Runoff from Intermittent Maintenance Activities during Operations	Operations and maintenance activities would result in minimal intermittent changes to drainage patterns and stormwater runoff. Approximately 172 waterbodies would be affected by bridge and culvert maintenance, vegetation management, and other operations conducted near waterbodies during intermittent maintenance activities. The application of BMPs, a SWPPP under the IGP, and an operations and maintenance plan under the Phase II MS4 permit would minimize potential impacts.	Impacts under Alternative 2 would be similar to Alternative 1; however, operations and maintenance would affect two more waterbodies (174).	Impacts under Alternative 3 would be similar to Alternative 1; however, operations and maintenance would affect three fewer waterbodies (169).	Impacts under Alternative 4 would be similar to Alternative 1; however, operations and maintenance would affect seven fewer waterbodies (165).

Resource Category	Operations Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Surface Water Quality				
Impact HYD#6: Impacts on Surface Water Quality from Intermittent Maintenance Activities during Operations	Station and maintenance facility activities, including train and materials storage, would result in minimal changes to surface water quality. Bridge and culvert maintenance and vegetation management would result in minimal impacts on surface water quality during intermittent maintenance activities. These activities would occur in or near 172 waterbodies. The design of stations and maintenance facilities, a SWPPP under the IGP, and an operations and maintenance plan under the Phase II MS4 permit would minimize potential impacts under Alternative 1.	Impacts under Alternative 2 would be similar to Alternative 1; however, operations and maintenance activities would occur in two more waterbodies (174).	Impacts under Alternative 3 would be similar to Alternative 1; however, operations and maintenance activities would occur in three fewer waterbodies (169).	Impacts under Alternative 4 would be similar to Alternative 1; however, operations and maintenance activities would occur in seven fewer waterbodies (165).
Impact HYD#7: Impacts on Surface Water Quality during Continuous Operations	Brake dust, PAHs, and other contaminants released by trains during ongoing operation of the rail would be deposited in 161 waterbodies. However, the electrical train technology with regenerative braking proposed for the HSR system and a stormwater management and treatment plan would minimize potential water quality impacts from brake dust and other contaminants to the maximum extent practicable using the best available technology.	Impacts under Alternative 2 would be similar to Alternative 1; however, brake dust and other contaminants would be deposited in three more waterbodies (164).	Impacts under Alternative 3 would be similar to Alternative 1; however, brake dust and other contaminants would be deposited in three fewer waterbodies (158).	Impacts under Alternative 4 would be similar to Alternative 1; however, brake dust and other contaminants would be deposited in nine fewer waterbodies (152).
Groundwater				
Impact HYD#12: Impacts on Groundwater Quality and Volume from Intermittent Maintenance Activities during Operations	There are new impervious surfaces, such as the Downtown Gilroy Station, that would be within groundwater recharge zones; however, operations and maintenance activities would minimally affect groundwater quality during intermittent maintenance activities. These activities would also not require dewatering, pumping, or other activities that would affect groundwater volume. The design of stations, maintenance facilities, a SWPPP under the IGP, and project features regarding the management, transport, and disposal of waste and materials will minimize impacts on groundwater quality.	Impacts under Alternative 2 would be the same as Alternative 1, because these alternatives would use the same stations, South Gilroy MOWF, and MOWS.	Impacts under Alternative 3 would be similar to Alternative 1 because the East Gilroy MOWF is in the same groundwater subbasin (Llagas Area) as the South Gilroy MOWF.	Impacts under Alternative 4 would be similar to Alternative 1 because the South Gilroy MOWF under Alternative 4 is in a different location in the Llagas Area subbasin than the MOWF in Alternative 1.
Impact HYD#13: Impacts on Groundwater Quality and Volume during Continuous Operations	Brake dust, PAHs, and other contaminants emitted by trains would minimally affect groundwater quality during operations and continuous dewatering of tunnels is not anticipated. The electrical train technology with regenerative braking proposed for the HSR system would not generate many pollutants and a stormwater management and treatment plan would reduce the potential for brake dust to percolate into groundwater aquifers using the best available technology.	Impacts under Alternative 2 would be similar to Alternative 1; brake dust would be deposited in different locations because of different track alignments between San Jose and Gilroy.	Impacts under Alternative 3 would be similar to Alternative 1; brake dust would be deposited in different locations because of different track alignments between San Jose and Gilroy.	Impacts under Alternative 4 would be similar to Alternative 1; brake dust would be deposited in different locations because of different track alignments between San Jose and Gilroy.
Floodplains				
Impact HYD#16: Impacts on Floodplain Hydraulics from Intermittent Maintenance Activities during Operations	Operations and maintenance activities would require intermittent activities in floodplains delineated by FEMA, including maintaining the flood control basin at the South Gilroy MOWF. Potential impacts would be minimized by monitoring weather forecasts for intense storms and flood conditions.	Impacts under Alternative 2 would be similar to Alternative 1; however, different floodplains would be affected by a larger footprint and by different alignments in the Morgan Hill and Gilroy Subsection.	Impacts under Alternative 3 would be similar to Alternative 1; however, different floodplains would be affected by different alignments in the Morgan Hill and Gilroy Subsection, including a flood control system for Dexter, San Ysidro, and Jones (Furlong) Creeks at the East Gilroy MOWF.	Impacts under Alternative 4 would be similar to Alternative 1; however, different floodplains would be affected by different alignments in the Morgan Hill and Gilroy Subsection and a smaller footprint.
Geology, Soils, Seismicity, and Paleontological Resources				
Impact GEO#11: Regional Ground Subsidence during Operations	Project features will minimize direct and indirect risks to life and property from differential ground movement resulting from ground subsidence by monitoring and maintaining the integrity of the track during operations.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Resource Category	Operations Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact GEO#12: Primary Seismic Hazards during Operations	Project features will minimize direct and indirect risks to life and property from surface fault rupture and ground shaking during operations. These project features include using seismic design standards in the structural design, use of early warning systems that would be triggered by strong ground motion, and shutting down train operations during or after an earthquake.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact GEO#13: Secondary Seismic Hazards during Operations	Project features will minimize direct and indirect risks to life and property resulting from ground deformation from secondary seismic hazards during operations. These project features include conforming to design guidelines specified by relevant transportation and building agencies such as AREMA, FHWA, and Caltrans, as well as long-term monitoring and maintenance.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Paleontological Resources				
Impact GEO#15: Destruction of Paleontological Resources during Operations	Operation of the project would not affect geologic units identified as having high or undetermined paleontological potential.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Hazardous Materials and Waste				
Impact HMW#11: Temporary and Intermittent Impacts from Transport, Use, Storage, and Disposal of Hazardous Materials and Wastes during Operations	Because HSR is a passenger train system, it is anticipated that only small quantities of hazardous materials would be used and small quantities of hazardous wastes would be generated during operations. Accordingly, the storage, usage, and generation of hazardous materials and wastes would occur primarily at maintenance facilities, which would have relevant BMPs in place to contain all hazardous materials and wastes within the maintenance facility.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Hazardous Material and Waste Impacts on Sensitive Receptors				
HMW#13: Intermittent Direct Impacts from Hazardous Materials and Wastes Activities in Proximity to Schools during Operation	Project operations would occur within 0.25 mile of 43 schools. As the HSR is planned as a passenger train, it is anticipated that only small quantities of hazardous materials would be transported during operations and that highest use of such materials would take place at maintenance facilities. Implementation of the materials storage procedures as outlined in the HMBP will limit the extent of any spilled material within a storage area to that storage facility.	Similar to Alternative 1, but operations would occur within 0.25 mile of 47 schools.	Similar to Alternative 1, but operations would occur within 0.25 mile of 41 schools.	Similar to Alternative 1, but operations would occur within 0.25 mile of 40 schools.
Safety and Security				
Emergency Response and Services				
Impact S&S#3: Permanent Impacts on Emergency Access and Response Times from Permanent Roadway and Highway Closures, Relocations, and Modifications	Travel time on Monterey Road would increase between Capitol Expressway and Bernal Road by 0 to 12 minutes in AM peak hours and 6 to 8 minutes in PM peak hours depending on the direction of travel, resulting in delays in emergency vehicle access and response time.	Travel time on Monterey Road would increase between Capitol Expressway and Bernal Road by 6 to 8 minutes in AM peak hours and by 2 to 12 minutes in PM peak hours depending on the direction of travel, resulting in delays in emergency vehicle access and response time.	Same as Alternative 1	Travel time on Monterey Road would not increase because of roadway modifications. However, because of additional gate down time, travel times between Bernal and Capitol Expressway would increase by less than 1 minute in AM peak hours, and 4 to 8 minutes in PM peak hours depending on the direction of travel, resulting in delays in emergency vehicle access and response time.

Resource Category	Operations Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact S&S#4: Continuous Permanent Impacts on Emergency Access and Response Times	Traffic generated by HSR riders at the San Jose Diridon Station and the Downtown Gilroy Station would result in an increase in emergency vehicle response times by 30 seconds or more. Travel time on Monterey Road would increase between Capitol Expressway and Bernal Road by 6 to 8 minutes in AM peak hours and 11 to 20 minutes in PM peak hours depending on the direction of travel, resulting in delays in emergency vehicle access and response time. These increases would be as a result of roadway modifications on Monterey Road. No delay because of additional gate down time.	Station traffic effects would be the same as Alternative 1. Travel time on Monterey Road would increase between Capitol Expressway and Bernal Road by 16 to 26 minutes in AM peak hours and by 5 to 17 minutes in PM peak hours depending on the direction of travel, resulting in delays in emergency vehicle access and response time. These increases would be as a result of roadway modifications on Monterey Road Same as Alternative 1.	Same as Alternative 1 except this alternative would not have station traffic effects on emergency vehicle response times relative to the East Gilroy Station.	Traffic generated by HSR riders at the San Jose Diridon Station and the Downtown Gilroy Station would result in an increase in emergency vehicle response times by 30 seconds or more. Additional gate down time would increase emergency vehicle response by 30 seconds or more in the Monterey Corridor and Morgan Hill and Gilroy Subsections. Travel time on Monterey Road would not increase because of roadway modifications. However, because of additional gate down time, travel times between Bernal and Capitol Expressway would increase by less than 1 minute in AM peak hours, and 4 to 8 minutes in PM peak hours depending on the direction of travel, resulting in delays in emergency vehicle access and response time.
Community Safety and Security				
Impact S&S#8: Permanent Exposure to Traffic Hazards	The project would result in 17 permanent local road closures and 27 permanent local road realignments. The project would construct overpasses and underpasses to route traffic over or under the HSR tracks, widen local roads, add new traffic signals, implement new traffic restrictions, improve intersections, and build new roads to address traffic hazards.	The project would result in 29 permanent local road closures and 59 permanent local road realignments. Project improvements would be the same as Alternative 1.	The project would result in 17 permanent local road closures and 32 permanent local road realignments. Project improvements would be the same as Alternative 1.	Alternative 4 would include construction of 29 at-grade quad gates at road-rail crossings in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections. Closure of at-grade crossing gates would result in traffic delays at at-grade intersections.
Impact S&S#9: Permanent Interference with Airport Safety	Project structures including proposed radio towers would exceed FAR Part 77 height notification limits and therefore notification to FAA would be required for these structures. Eight radio towers would require FAA notification for Alternative 1. The Authority expects that the aeronautical studies that FAA would conduct under the FAR Part 77 notification process would not result in identification of safety hazards that would result in FAA recommending the relocation of a proposed communications tower or other proposed structure.	Same as Alternative 1, except six radio towers would require FAA notification for Alternative 2.	Same as Alternative 1, except six radio towers would require FAA notification for Alternative 3.	Same as Alternative 1, except three radio towers would require FAA notification for Alternative 4.
Impact S&S#12: Permanent Exposure to Rail-Related Hazards	The project would permanently affect 120 acres of UPRR right-of-way and another 87 acres for temporary construction easements. From Tamien Station to Bloomfield Avenue in Gilroy, the UPRR and HSR run parallel for 24.4 miles. Alternative 1 would include 2.6 miles of blended track, 86.3 miles of dedicated track and would include no at-grade crossings. The project design includes grade separations, physical separations including separation distances and vertical separations, a physical protection barrier, PTC features, and derailment containment to maximize operational safety.	The project construction would permanently affect 127 acres of UPRR right-of-way and another 227 acres for temporary construction easements. From Tamien Station to Bloomfield Avenue in Gilroy, the UPRR and HSR run parallel for 31.4 miles. Alternative 2 would include 88.6 miles of dedicated track and no blended track and would include no at-grade crossings. The project design features would be the same as Alternative 1.	The project would permanently affect 81 acres of UPRR right-of-way and another 75 acres for temporary construction easements. From Tamien Station to Bloomfield Avenue in Gilroy, the UPRR and HSR run parallel for 16.4 miles. Alternative 3 would include 88.6 miles of dedicated track and no blended track and would include no at-grade crossings The project design features would be the same as Alternative 1.	The project would permanently affect 450 acres of UPRR right-of-way and another 4 acres for temporary construction easements. For Alternative 4, the HSR would run on blended track for 35.3 miles between San Jose and Gilroy. Alternative 4 would include 53.4 miles of dedicated track and 35.3 miles of blended track. Alternative 4 would include installation of 7 new quad gates and improvements to 74 existing gates at at-grade crossings in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections. The project design features would be the same as Alternative 1. At-grade crossings would be equipped with quad gates and barrier systems to prevent intrusion into the right-of-way.

Resource Category	Operations Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact S&S#13: Continuous Permanent Exposure to High-Risk Facilities and Tall Structures	Following construction, 41 high-risk utility facilities would remain within the RSA. A total of 16 bridges and no other tall structures would remain within the RSA after completion of construction. There are 96 high-risk facilities including cement plants, electric power plants, wastewater treatment plants, dams and reservoirs, and landfills within 2 miles of the project footprint. The project would conduct a PHA and include the SSMP to minimize the potential for high-risk facilities, including oil and natural gas pipelines, bulk fuel storage facilities, and tall structures (including bridges).	Following construction, 37 high-risk utility facilities would remain within the RSA. A total of 17 bridges and one other tall structure would remain within the RSA after completion of construction. There are 95 high-risk facilities including cement plants, electric power plants, wastewater treatment plants, dams and reservoirs, and landfills within 2 miles of the project footprint. The project features would be the same as Alternative 1.	Following construction, 41 high-risk utility facilities would remain within the RSA. A total of 17 bridges and one other tall structure would remain within the RSA after completion of construction. There are 96 high-risk facilities including cement plants, electric power plants, wastewater treatment plants, dams and reservoirs, and landfills within 2 miles of the project footprint. The project features would be the same as Alternative 1.	Following construction, 81 high-risk utility facilities would remain within the RSA. A total of 27 bridges and six other tall structures would remain within the RSA after completion of construction. There are 93 high-risk facilities including cement plants, electric power plants, wastewater treatment plants, dams and reservoirs, and landfills within 2 miles of the project footprint. The project features would be the same as Alternative 1.
Impact S&S#14: Continuous Permanent Exposure to Criminal and Terrorist Activity	Operations would not lead to increased exposure to criminal or terrorist activity. The project includes deterrence and detection systems, and design standards and guidelines to accommodate emergency response access and provide for safe evacuation in the event of a criminal or terrorist act.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact S&S#15: Continuous Permanent Safety Hazard to Schools	The ATC system, intrusion detection system, and inspection and maintenance programs would minimize the risk of accidents, and derailment containment systems including check rails, parapets, undercar guards, and alternate barrier systems would keep the train within the right-of-way and railcars upright in the event of a derailment, minimizing the safety risk at the 43 schools in the RSA.	Same as Alternative 1 for the 47 schools in the RSA.	Same as Alternative 1 for the 41 schools in the RSA.	Same as Alternative 1 for the 40 schools in the RSA.
Impact S&S#16: Wildfire Hazards	1,932 acres are within moderate to very high fire hazard severity zones, 1,518 acres of which are permanent area acreage. The risks of fires during operations would be minimized with the low use of flammable materials, and risks from wildfires that could result in safety hazards would be effectively minimized through fire and life safety programs during project design, construction, and operations.	1,940 acres are within moderate to very high fire hazard severity zones, 1,523 acres of which are permanent area acreage. The project design features would be the same as Alternative 1.	1,930 acres are within moderate to very high fire hazard severity zones, 1,510 acres of which are permanent area acreage. The project design features would be the same as Alternative 1.	1,929 acres are within moderate to very high fire hazard severity zones, 1,520 acres of which are permanent area acreage. The project design features would be the same as Alternative 1.
Socioeconomics and Communities				
Communities and Neighborhoods				
Impact SOCIO #3: Disruption or Division of Established Communities from HSR Operations	The overall HSR system in the long term would improve regional access, reduce travel times, and could reduce interregional traffic on regional roadways.	Same as Alternative 1.	Similar to Alternative 1, except VMT would be increased for the East Gilroy Station compared to the other project alternatives and could result in greater community disruption in the east Gilroy area.	Similar to Alternative 1, except there would be no grade separations between San Jose and downtown Gilroy, leading to greater delays to cross the rail line compared to other alternatives.
Impact SOCIO #3: Disruption or Division of Established Communities from Changes to Air Quality from HSR Operations	With a reduction of regional automobile travel and associated emissions, the project would improve regional air quality.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact SOCIO #3: Disruption or Division of Established Communities from Changes to Noise and Vibration from HSR Operations	Operations would result in severe noise impacts on 337 sensitive receptors (347 with the DDV).	Operations would result in severe noise impacts on 755 sensitive receptors (766 with the TDV).	Operations would result in severe noise impacts on 222 sensitive receptors (233 with the TDV).	Similar to Alternative 2, except operations would result in severe noise impacts on 1,212 sensitive receptors (1,224 with the TDV). There would be potential indirect noise effects on confined animals within approximately 285 feet of the edge of the HSR right-of-way, depending on train speed.
Impact SOCIO #3: Disruption or Division of Established Communities from Changes to Aesthetics and Visual Quality from HSR Operations	Train vehicle headlights and maintenance facility nighttime operations would introduce a new source of substantial light and glare and would diminish views of the nighttime sky in the rural areas of the project.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1

Resource Category	Operations Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact SOCIO #3: Disruption or Division of Established Communities from Changes to Community Safety and Security from HSR Operations	Roads crossing the project alignment would be fully grade-separated from the right-of-way, minimizing risks to the community that could lead to disruption.	Same as Alternative 1.	Same as Alternative 1.	Similar to Alternative 1 except that existing at-grade crossings would be used and improved with four-quadrant gates.
Children's Health and Safety				
Impact SOCIO #5: Operations Impacts on Children's Health and Safety	Project operations would not result in continuous impacts on children's health and safety.	Same as Alternative 1	Similar to Alternative 1, except that emissions would be greater for Alternative 3 because of the greater VMT associated with the East Gilroy Station.	Same as Alternative 1 except operational noise impacts would be the greatest because of HSR and freight train horn soundings between San Jose and downtown Gilroy, where the alignment would use existing at-grade rail crossings and no new grade separations would be constructed.
Economic Impacts				
Impact SOCIO #17: Operations Impacts on Employment	Project operations would provide approximately 1,110 direct and indirect jobs annually.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Operations Impacts on Population Growth (See Section 3.18, Regional Growth).	Operation of the project is expected to induce population growth in the three-county region.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact SOCIO #13: Operations Impacts on the Agriculture Economy	There would be no direct impacts on the agricultural economy from project operations. With respect to indirect impacts, animals housed within 100 feet of the track centerline or proposed maintenance facility footprint could be affected by operational noise.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact SOCIO #18: Operations Impacts on Property Taxes	Project operations could result in property value reductions in some locations because of increased noise, light and glare. There would likely be an increase in property values in the vicinity of the HSR stations.	Same as Alternative 1.	Similar to Alternative 1, except there would be slightly less beneficial impact on property values in the station areas because no transit-oriented development is planned for the East Gilroy Station area.	Same as Alternative 1.
Impact SOCIO #18: Operations Impacts on Sales Tax Revenues	Sales taxes would likely increase in the three-county region from materials being purchased by HSR riders and employees.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact SOCIO #19: Permanent Impact on Private Recreational Waterfowl Hunting	Project operation would not affect the overall economic viability of waterfowl hunting activities in the GEA.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Station Planning, Land Use, and Development				
Alteration of Land Use Patterns				
Impact LU#5: Permanent Indirect Impacts on Land Use Patterns from Increased Noise, Light, and Glare	The project would avoid or minimize noise and lights from operations. Although some residents may choose to relocate away from the alignment, such relocations would not result in a substantial change in land use patterns.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Inducement of Population Growth beyond Planned Levels				
Impact LU#7: Permanent Induced Population Growth	Population growth that might be induced by increased employment opportunities for HSR operations would not be considered substantial or exceed planned levels locally or regionally. The increase in employment would be beneficial to the local economy. Because adopted and planned station area and specific plans encourage TOD, Alternative 1 would not induce population growth beyond planned levels.	Same as Alternative 1.	Operation of the East Gilroy HSR station and the East Gilroy MOWF would not stimulate population growth in the vicinity beyond planned levels.	Same as Alternative 1.

Resource Category	Operations Impacts under the Project Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Parks, Recreation, and Open Space				
Parks, Recreation, and Open Space Resources				
Impact PK#7: Permanent Changes from Noise and Vibration on Parks, Recreation, and Open Space Resource Character and Use	Operations would result in permanent effects from noise on Los Banos Wildlife Area and in the parking area for the Volta Wildlife Area. No vibration impacts would occur.	Operations would result in permanent effects from noise on Morgan Hill Community and Cultural Center and Los Banos Wildlife Area and in the parking area for the Volta Wildlife Area. No vibration impacts would occur.	Same as Alternative 1.	Operations would result in permanent effects from noise on Highway 87 Bikeway North, Edenvale Gardens Regional Park, Morgan Hill Community and Cultural Center, Los Banos Wildlife Area and in the parking area for the Volta Wildlife Area. Permanent vibration effects would occur at Highway 87 Bikeway.
Impact PK#8: Physical Alteration of Existing Facilities or a Need to Provide New Parks or Other Recreational Facilities, the Construction of Which Could Cause Significant Environmental Impact	No new parks or other recreational facilities would need to be constructed to accommodate demand.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
School District Play Areas				
Impact PK#15: Permanent Changes from Noise and Vibration on School District Play Area Character and Use	No moderate or severe operational noise or vibration impacts would occur.	Same as Alternative 1.	Same as Alternative 1.	Operations would result in permanent effects from noise on Gilroy Prep School. No vibration impacts would occur.
Cultural Resources				
Impact CUL#6: Intermittent Noise and Vibration Impacts on Built Resources Caused by Operations	0 built resources adversely affected.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.

[1] Impacts associated with the design variants are shown in parentheses. The DDV affects Alternative 4 within the San Jose Diridon Station Approach Subsection; the TDV affects all alternatives within the Morgan Hill and Gilroy, Pacheco Pass, and San Joaquin Valley Subsections.

AREMA = American Railway Engineering and Maintenance-of-Way Association
ATC = automatic train control
BMP = best management practice
Caltrans = California Department of Transportation
CEQA = California Environmental Quality Act
CP = control point
dBA = A-weighted decibel
DDV = Diridon design variant
EMF = electromagnetic frequency
EMI = electromagnetic interference
FAA = Federal Aviation Administration
FAR = Federal Aviation Regulation
FCC = Federal Communications Commission
FEMA = Federal Emergency Management Agency
FHWA = Federal Highway Administration
GEA = Grasslands Ecological Area
HMBP = hazardous materials business plan
HSR = high-speed rail
I = Interstate
IBA = Important Bird Area
IGP = Individual General Permit
L_{dn} = day-night sound level, dBA
LOS = level of service
mG = milligauss
MMBtu = million British thermal units
MOWS = maintenance of way siding
MOWF = maintenance of way facility
MPE = maximum permissible exposure
mph = miles per hour
MS4 = municipal separate storm sewer system
OCS = overhead contact system
PHA = preliminary hazard analysis
PTC = positive train control
RSA = resource study area
SSMP = safety and security management plan
SWPPP = stormwater pollution prevention plan
TDV = tunnel design variant
TOD = transit-oriented development
UPR = Upper Pajaro River
UPRR = Union Pacific Railroad
US = U.S. Highway
VMT = vehicle miles traveled
WEAP = Worker Environmental Awareness Program

This Page Intentionally Left Blank

S.8.4 Comparison of HSR Stations

As described in Section S.5.3, Station Area Development, two stations would be constructed for the project: one in San Jose and one in Gilroy. The San Jose Diridon HSR Station would be constructed at the existing Caltrain station. The station configuration would be aerial under Alternatives 1, 2, and 3, and it would be identical under all three alternatives. Under Alternative 4 it would be built as an at-grade station. As described in Section S.8.3.5, the DDV that is available for Alternative 4 would allow for higher speeds in the approaches and through Diridon Station. The Gilroy station would be constructed in either downtown Gilroy (Alternatives 1, 2, or 4) or east Gilroy (Alternative 3). The Downtown Gilroy Station would be located on the east side of the UPRR tracks under Alternatives 1 and 2, but on the west side under Alternative 4. A comparative discussion of the station-related impacts is included in Section S.8.3.

S.8.5 Comparison of Maintenance Facilities

MOWFs provide for dispatch, maintenance, and repair of rail-mounted equipment and include support quarters for maintenance personnel. As described in Section S.5.4, Maintenance Facilities, there are three potential locations for the MOWF. The South Gilroy MOWF between Carnadero Avenue and Bloomfield Avenue on the east side of the HSR alignment would be constructed under Alternatives 1 and 2. The South Gilroy MOWF south of Bloomfield Avenue on the west side of the HSR alignment would be constructed under Alternative 4. Lastly, the East Gilroy MOWF would be constructed under Alternative 3. A comparative discussion of impacts associated with these three sites is included in Section S.8.3.

S.8.6 CEQA Summary of Impacts and Mitigation

Table S-5 provides a summary of the CEQA determination of significant impacts for the project alternatives. Where feasible, mitigation measures would be applied to avoid or reduce impacts from construction and operations of the project alternatives. A determination of the level of significance after mitigation measures is also required under CEQA. In most cases these mitigation measures will reduce the impacts to a less-than-significant level. Only EMF/EMI resources and Socioeconomics and Communities would not have significant impacts under CEQA for the project alternatives and would not require mitigation; although SO-MM#1 will be implemented to reduce impacts associated with residential displacement in certain areas.

Table S-5 CEQA Summary of Resources with Significant Impacts and Applicable Mitigation Measures

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Transportation			
Transit			
Construction	All Alternatives: Impact TR #10: Temporary Impacts on Bus Transit	TR-MM#2: Install Transit Signal Priority	Significant and Unavoidable (Alternatives 1, 2, and 3) Less than Significant (Alternative 4)
Construction	All Alternatives: Impact TR #11: Temporary Impacts on Passenger Rail Operations	TR-MM#3: Railway Disruption Control Plan	Less than Significant
Construction	All Alternatives: Impact TR #12: Permanent Impacts on Bus Transit	TR-MM#2: Install Transit Signal Priority	Less than Significant
Operations	All Alternatives: Impact TR #13: Continuous Permanent Impacts on Bus Services	TR-MM#2: Install Transit Signal Priority	Less than Significant
Freight Rail Service			
Construction	All Alternatives: Impact TR #20: Temporary Impacts on Freight Rail Operations	TR-MM#3: Railway Disruption Control Plan	Less than Significant
Air Quality and Greenhouse Gases[3]			
Construction	All Alternatives: Impact AQ#1: Temporary Direct and Indirect Impacts on Air Quality within the SFBAAB	AQ-MM#1: Implement Additional On-Site Emissions Controls to Reduce Fugitive Dust AQ-MM#2: Construction Emissions Reductions – Requirements for use of Zero Emission (ZE) and/or Near Zero Emission (NZE) Vehicles and off-road equipment AQ-MM#3: Offset Project Construction Emissions in the SFBAAB	Less than Significant
Construction	All Alternatives: Impact AQ#3: Temporary Direct and Indirect Impacts on Air Quality within the SJVAB	AQ-MM#1: Implement Additional On-Site Emissions Controls to Reduce Fugitive Dust AQ-MM#2: Construction Emissions Reductions – Requirements for use of Zero Emission (ZE) and/or Near Zero Emission (NZE) Vehicles and off-road equipment AQ-MM#4: Offset Project Construction Emissions in the SJVAB	Less than Significant (NO_X and PM_{10}) Significant and Unavoidable (CO)

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Construction	All Alternatives: Impact AQ#4: Temporary Direct Impacts on Implementation of an Applicable Air Quality Plan	AQ-MM#1: Implement Additional On-Site Emissions Controls to Reduce Fugitive Dust AQ-MM#2: Construction Emissions Reductions – Requirements for use of Zero Emission (ZE) and/or Near Zero Emission (NZE) Vehicles and off-road equipment AQ-MM#3: Offset Project Construction Emissions in the SFBAAB AQ-MM#4: Offset Project Construction Emissions in the SJVAB	Less than Significant
Construction	All Alternatives: Impact AQ#5: Temporary Direct Impacts on Localized Air Quality—Criteria Pollutants	AQ-MM#1: Implement Additional On-Site Emissions Controls to Reduce Fugitive Dust AQ-MM#2: Construction Emissions Reductions – Requirements for use of Zero Emission (ZE) and/or Near Zero Emission (NZE) Vehicles and off-road equipment	Significant and Unavoidable[4]
Noise and Vibration			
Noise			
Construction	All Alternatives: Impact NV#1: Temporary Exposure of Sensitive Receptors to Construction Noise	NV-MM#1: Construction Noise Mitigation Measures	Significant and Unavoidable for all project alternatives
Operations	All Alternatives: Impact NV#2: Intermittent Permanent Exposure of Sensitive Receptors to Noise from Train Operations	NV-MM#3: Implement Proposed California High-Speed Rail Project Noise Mitigation Guidelines NV-MM#4: Support Potential Implementation of Quiet Zones by Local Jurisdictions NV-MM#5: Vehicle Noise Specification NV-MM#6: Special Trackwork at Crossovers, Turnouts, and Insulated Joints NV-MM#7: Additional Noise Analysis during Final Design BIO-MM#80: Minimize Permanent Intermittent Noise, Visual, and Train Strike Impacts on Wildlife Movement	Significant and Unavoidable for all project alternatives
Operations	All Alternatives: Impact NV#6: Permanent Exposure of Sensitive Receptors to Vehicular Traffic Noise Increases	NV-MM#3: Implement Proposed California High-Speed Rail Project Noise Mitigation Guidelines NV-MM#7: Additional Noise Analysis during Final Design	Significant and Unavoidable for all project alternatives

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Operations	All Alternatives: Impact NV#8: Permanent Exposure of Sensitive Receptors to Traction Power Facility Noise	NV-MM#3: Implement Proposed California High-Speed Rail Project Noise Mitigation Guidelines NV-MM#7: Additional Noise Analysis during Final Design	Less than Significant with Mitigation
Vibration			
Construction	All Alternatives: Impact NV#9: Temporary Exposure of Sensitive Receptors and Buildings to Construction Vibration	NV-MM#2: Construction Vibration Mitigation Measures	Less than Significant for all project alternatives
Operations	All Alternatives: Impact NV#10: Intermittent Permanent Exposure of Sensitive Receptors to Vibration from Operations	NV-MM#8: Project Vibration Mitigation Measures	Significant and Unavoidable for all project alternatives (although preliminary review indicates that most, if not all, significant impacts for Alternatives 1, 2, and 3 may be avoided with mitigation and for Alternative 4 all but 15 significant impacts may be avoided with mitigation)
Public Utilities and Energy			
Construction	Alternatives 1 and 2: Impact PUE#4: Permanent Conflicts with Existing Major Utilities Requiring Relocation	PUE-MM#1: Replace Percolation Ponds at SCRWA WWTP	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Biological and Aquatic Resources			
Construction	All Alternatives: Impact BIO#1: Permanent Conversion or Degradation of Habitat for Special-Status Plant Species	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#7: Conduct Botanical Surveys for Special-Status Plant Species and Special-Status Plant Communities BIO-MM#8: Prepare and Implement Plan for Salvage, Relocation, and/or Propagation of Special-Status Plant Species BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#11: Implement Measures to Minimize Impacts During Off-Site Habitat Restoration, or Enhancement, or Creation on Mitigation Sites BIO-MM#12: Provide Compensatory Mitigation for Impacts on Listed Plant Species	Less than Significant
Construction	All Alternatives: Impact BIO#2a: Permanent Conversion or Degradation of Habitat for and Mortality of Bay Checkerspot Butterfly	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#14: Avoid Direct Impacts on Bay Checkerspot and Monarch Butterfly Host Plants BIO-MM#15: Prepare and Implement Bay Checkerspot Butterfly Protection Plan BIO-MM#16: Provide Compensatory Mitigation for Impacts on Bay Checkerspot Butterfly Habitat	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Construction	All alternatives: Impact BIO#2b: Permanent Conversion or Degradation of Habitat for and Mortality of Monarch Butterfly	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Adaptive Management and Monitoring Plan BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#14: Avoid Direct Impacts on Bay Checkerspot and Monarch Butterfly Host Plants BIO-MM#86: Provide Compensatory Mitigation for Impacts on Monarch Butterfly Habitat	Less than Significant
Construction	All Alternatives: Impact BIO#3: Permanent Conversion or Degradation of Habitat for and Mortality of Vernal Pool Crustaceans	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#17: Conduct Pre-Construction Surveys for Vernal Pool Wildlife Species BIO-MM#18: Implement Seasonal Vernal Pool Work Restriction BIO-MM#19: Implement and Monitor Vernal Pool Avoidance Minimization Measures within Temporary Impact Areas BIO-MM#20: Provide Compensatory Mitigation for Impacts on Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp Habitat	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Construction	All Alternatives: Impact BIO#4: Removal or Pruning of Elderberry Plants Potentially Supporting Valley Elderberry Longhorn Beetle	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#11: Implement Measures to Minimize Impacts During Off-Site Habitat Restoration, or Enhancement, or Creation on Mitigation Sites BIO-MM#13: Implement Work Stoppage BIO-MM#21: Implement Avoidance Measures for Elderberry Shrubs outside Permanent Impact Areas BIO-MM#22: Provide Compensatory Mitigation for Impacts on Valley Elderberry Longhorn Beetle Habitat	Less than Significant
Construction	All Alternatives: Impact BIO#5: Permanent Conversion or Degradation of Habitat for and Mortality of Crotch's Bumble Bee	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#12: Provide Compensatory Mitigation for Impacts on Listed Plant Species BIO-MM#23: Conduct Surveys and Implement Avoidance Measures for Crotch's Bumble Bee BIO-MM#24: Provide Compensatory Mitigation for Impacts on Crotch's Bumble Bee	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Construction	All Alternatives: Impact BIO#6: Permanent Conversion of Habitat for and Direct Mortality of Steelhead and Pacific Lamprey, and All Alternatives: Permanent Conversion of Essential Fish Habitat for Chinook Salmon	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#25: Prepare Plan for Dewatering and Water Diversions BIO-MM#26: Prepare and Implement a Fish Rescue Plan BIO-MM#27a: Implement General Protection Measures for Fish BIO-MM#27b: Work Windows for Fish BIO-MM#27c: Prepare and Implement an Underwater Sound Control Plan BIO-MM#28: Provide Compensatory Mitigation for Permanent Impacts on Steelhead Habitat and Essential Fish Habitat for Pacific Coast Salmon	Less than Significant
Construction	All Alternatives: Impact BIO#7: Permanent Conversion or Degradation of Habitat for and Direct Mortality of California Tiger Salamander	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#29: Conduct Pre-Construction Surveys for California Tiger Salamander BIO-MM#30: Implement Avoidance and Minimization Measures for California Tiger Salamander BIO-MM#31: Provide Compensatory Mitigation for Impacts on California Tiger Salamander Habitat	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Construction	All Alternatives: Impact BIO#8: Permanent Conversion or Degradation of Habitat for and Direct Mortality of California Red-Legged Frog	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#32: Conduct Pre-Construction Surveys and Implement Avoidance and Minimization Measures for California Red-Legged Frog BIO-MM#33: Provide Compensatory Mitigation for Impacts on California Red-Legged Frog Habitat	Less than Significant
Construction	All Alternatives: Impact BIO#9: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Foothill Yellow-Legged Frog	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#34: Conduct Pre-construction Surveys and Implement Avoidance and Minimization Measures for Foothill Yellow-Legged Frog BIO-MM#35: Provide Compensatory Mitigation for Impacts on Foothill Yellow-Legged Frog Habitat	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Construction	All Alternatives: Impact BIO#10: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Western Spadefoot	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#13: Implement Work Stoppage BIO-MM#36: Conduct Pre-Construction Surveys for Special-Status Reptiles and Amphibians BIO-MM#37: Implement Avoidance and Minimization Measures for Special-Status Reptiles and Amphibians	Less than Significant
Construction	All Alternatives: Impact BIO#11: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Western Pond Turtle	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#13: Implement Work Stoppage BIO-MM#36: Conduct Pre-Construction Surveys for Special-Status Reptiles and Amphibians BIO-MM#37: Implement Avoidance and Minimization Measures for Special-Status Reptiles and Amphibians	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Construction	All Alternatives: Impact BIO#12: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Blunt-Nosed Leopard Lizard	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#38: Conduct Surveys for Blunt-Nosed Leopard Lizard BIO-MM#39: Implement Avoidance Measures for Blunt-Nosed Leopard Lizard BIO-MM#40: Provide Compensatory Mitigation for Impacts on Blunt-Nosed Leopard Lizard Habitat	Less than Significant
Construction	All Alternatives: Impact BIO#13: Permanent Conversion or Degradation of Habitat for and Direct Mortality of San Joaquin Coachwhip, Northern California Legless Lizard, and Coast Horned Lizard	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#36: Conduct Pre-Construction Surveys for Special-Status Reptiles and Amphibians BIO-MM#37: Implement Avoidance and Minimization Measures for Special-Status Reptiles and Amphibians	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Construction	All Alternatives: Impact BIO#14: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Giant Garter Snake	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#41: Conduct Pre-Construction Surveys and Implement Avoidance and Minimization Measures for Giant Garter Snake BIO-MM#42: Provide Compensatory Mitigation for Impacts on Giant Garter Snake Habitat	Less than Significant
Construction	All Alternatives: Impact BIO#15: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Short-Eared Owl and Grasshopper Sparrow	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#43: Conduct Pre-Construction Surveys and Delineate Active Nest Buffers for Breeding Birds	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Construction	All Alternatives: Impact BIO#16: Permanent Conversion or Degradation of Habitat for Mountain Plover and Disturbance of Western Snowy Plover (Interior Population)	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#43: Conduct Pre-Construction Surveys and Delineate Active Nest Buffers for Breeding Birds BIO-MM#44: Implement Avoidance and Minimization Measures for Mountain Plover and Sandhill Crane	Less than Significant
Construction	All Alternatives: Impact BIO#17: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Burrowing Owl	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#45: Conduct Surveys for Burrowing Owl BIO-MM#46: Implement Avoidance and Minimization Measures for Burrowing Owl BIO-MM#47: Provide Compensatory Mitigation for Loss of Active Burrowing Owl Burrows and Habitat	Less than Significant
Construction	All Alternatives: Impact BIO#18: Permanent Conversion or Degradation of Habitat for and Disturbance of Golden Eagle and Bald Eagle	BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#48: Conduct Pre-Construction Surveys for Eagles BIO-MM#49: Implement Avoidance Measures for Active Eagle Nests BIO-MM#50: Provide Compensatory Mitigation for Loss of Eagle Nests	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Construction	All Alternatives: Impact BIO#19: Injury or Disturbance of California Condor	BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#51: Implement Avoidance Measures for California Condor	Less than Significant
Construction	All Alternatives: Impact BIO#20: Permanent Conversion or Degradation of Habitat for and Disturbance of Special-Status Raptors (American Peregrine Falcon, Northern Harrier, White-Tailed Kite) and Other Raptors	BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#52: Conduct Pre-Construction Surveys and Monitoring for Raptors	Less than Significant
Construction	All Alternatives: Impact BIO#21: Permanent Conversion or Degradation of Habitat for and Disturbance of Swainson's Hawks	BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#53: Conduct Surveys for Swainson's Hawks Nests BIO-MM#54: Implement Avoidance and Minimization Measures for Swainson's Hawk Nests BIO-MM#55: Provide Compensatory Mitigation for Loss of Swainson's Hawk Nesting Trees and Habitat	Less than Significant
Construction	All Alternatives: Impact BIO#22: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Purple Martin, Olive-Sided Flycatcher, and Loggerhead Shrike	BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#43: Conduct Pre-Construction Surveys and Delineate Active Nest Buffers for Breeding Birds	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Construction	All Alternatives: Impact BIO#23: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Least Bell's Vireo, Yellow Warbler, and Yellow-Breasted Chat	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#13: Implement Work Stoppage BIO-MM#43: Conduct Pre-Construction Surveys and Delineate Active Nest Buffers for Breeding Birds BIO-MM#72: Provide Compensatory Mitigation for Permanent Impacts on Riparian Habitat	Less than Significant
Construction	All Alternatives: Impact BIO#24: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Tricolored Blackbird and Yellow-Headed Blackbird	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Plan BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#56: Conduct Surveys and Implement Avoidance Measures for Active Tricolored Blackbird Nest Colonies BIO-MM#57: Provide Compensatory Mitigation for Impacts on Tricolored Blackbird Habitat	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Construction	All Alternatives: Impact BIO#25: Permanent Conversion or Degradation of Habitat for and Disturbance of Sandhill Crane	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#44: Avoid or Minimize Disturbance on Mountain Plover and Sandhill Crane BIO-MM#58: Provide Compensatory Mitigation for Impacts on Waterfowl, Shorebird, and Sandhill Crane Habitat	Less than Significant
Construction	All Alternatives: Impact BIO#26a: Loss of Breeding, Foraging, and Dispersal Habitat for and Direct Mortality or Disturbance of Mountain Lion	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#87: Conduct Pre-Construction Surveys and Implement Avoidance and Minimization Measures for Mountain Lion Dens BIO-MM#88: Provide Compensatory Mitigation for Impacts on Mountain Lion Habitat	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Construction	All Alternatives: Impact BIO#26b: Loss of Denning and Dispersal Habitat for and Direct Mortality or Disturbance of San Joaquin Kit Fox	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#59: Conduct Pre-Construction Surveys for San Joaquin Kit Fox BIO-MM#60: Implement San Joaquin Kit Fox Avoidance and Minimization Measures BIO-MM#61: Provide Compensatory Mitigation for Impacts on San Joaquin Kit Fox Habitat	Less than Significant
Construction	All Alternatives: Impact BIO#27: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Fresno Kangaroo Rat	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#62: Implement Avoidance and Minimization Measures for Fresno Kangaroo Rat BIO-MM#63: Provide Compensatory Mitigation for Impacts on Fresno Kangaroo Rat Habitat	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Construction	All Alternatives: Impact BIO#28: Permanent Conversion or Degradation of Habitat for and Direct Mortality of American Badger	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#64: Conduct Pre-Construction Surveys for American Badger Den Sites and Implement Avoidance and Minimization Measures	Less than Significant
Construction	All Alternatives: Impact BIO#29: Permanent Conversion or Degradation of Habitat for and Direct Mortality of San Francisco Dusky-Footed Woodrat and Ringtail	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#65: Conduct Pre-Construction Surveys for Ringtail and Ringtail Den Sites and Implement Avoidance Measures BIO-MM#66: Conduct Pre-Construction Surveys for Dusky-Footed Woodrat and Implement Avoidance Measures	Less than Significant
Construction	All Alternatives: Impact BIO#30: Loss of Roost Sites for and Direct Mortality or Disturbance of Special-Status Bats	BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#67: Conduct Pre-Construction Surveys for Special-Status Bat Species BIO-MM#68: Implement Bat Avoidance and Relocation Measures BIO-MM#69: Implement Bat Exclusion and Deterrence Measures	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Operations	All Alternatives: Impact BIO#31: Intermittent Disturbance of Habitat for Special-Status Plants during Operations	BIO-MM#70: Prepare and Implement an Annual Vegetation Control Plan	Less than Significant
Operations	All Alternatives: Impact BIO#32: Intermittent Disturbance of Habitat for and Direct Mortality of Special-Status Wildlife during Operations	BIO-MM#70: Prepare and Implement an Annual Vegetation Control Plan	Less than Significant
Construction	All Alternatives: Impact BIO#34: Removal or Degradation of Habitat for and Disturbance of Waterfowl and Shorebirds	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#58: Provide Compensatory Mitigation for Impacts on Waterfowl, Shorebird, and Sandhill Crane Habitat	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Construction	All Alternatives: Impact BIO#35: Permanent Conversion or Degradation of Special-Status Plant Communities	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#7: Conduct Botanical Surveys for Special-Status Plant Species and Special-Status Plant Communities BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#71: Restore Temporary Riparian Impacts BIO-MM#72: Provide Compensatory Mitigation for Permanent Impacts on Riparian Habitat	Less than Significant
Operations	All Alternatives: Impact BIO#36: Intermittent Disturbance or Degradation of Special-Status Plant Communities during Operations	BIO-MM#70: Prepare and Implement an Annual Vegetation Control Plan	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Construction	All Alternatives: Impact BIO#37: Permanent Conversion or Degradation of Aquatic Resources Considered Jurisdictional under Section 404 of the Clean Water Act or Regulated by the State	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#25: Prepare Plan for Dewatering and Water Diversions BIO-MM#71: Restore Temporary Riparian Impacts BIO-MM#72: Provide Compensatory Mitigation for Permanent Impacts on Riparian Habitat BIO-MM#73: Restore Aquatic Resources Subject to Temporary Impacts BIO-MM#74: Prepare and Implement a Compensatory Mitigation Plan for Impacts on Aquatic Resources	Less than Significant
Construction	All Alternatives: Impact BIO#38: Permanent Conversion or Degradation of Resources Regulated under California Fish and Game Code Section 1600 et seq.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#25: Prepare Plan for Dewatering and Water Diversions BIO-MM#71: Restore Temporary Riparian Impacts BIO-MM#72: Provide Compensatory Mitigation for Permanent Impacts on Riparian Habitat BIO-MM#73: Restore Aquatic Resources Subject to Temporary Impacts BIO-MM#74: Prepare and Implement a Compensatory Mitigation Plan for Impacts on Aquatic Resources	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Operations	All Alternatives: Impact BIO#39: Intermittent Disturbance or Degradation of Aquatic Resources during Operations	BIO-MM#70: Prepare and Implement an Annual Vegetation Control Plan	Less than Significant
Construction	All Alternatives: Impact BIO#40: Removal of Trees Protected under Municipal Tree Ordinances	BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#75: Implement Transplantation and Compensatory Mitigation for Protected Trees	Less than Significant
Construction	All Alternatives: Impact BIO#42: Temporary Disruption of Wildlife and Wildlife Movement	BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#25: Prepare Plan for Dewatering and Watering Diversions BIO-MM#76a: Minimize Impacts on Wildlife Movement during Construction BIO-MM#76b: Minimize Impacts on Wildlife Movement in the Western Pacheco Pass Region BIO-MM#79a: Provide Wildlife Movement between the Santa Cruz Mountains and Diablo Range	Less than Significant
Operations	All Alternatives: Impact BIO#43: Permanent Impacts on Wildlife Movement	BIO-MM#77a: Design Wildlife Crossings to Facilitate Wildlife Movement BIO-MM#77b: Monitoring and Adaptive Management of Wildlife Crossings BIO-MM#78: Establish Wildlife Crossings at Embankment in West Slope of Pacheco Pass BIO-MM#79a: Provide Wildlife Movement between the Santa Cruz Mountains and Diablo Range BIO-MM#79b: Provide Wildlife Movement between the Diablo Range and Inner Coast Range (for cumulative impacts to wildlife movement)	Less than Significant
Operations	All Alternatives: Impact BIO#44: Intermittent Noise Disturbance of Wildlife Using Corridors during Operations	BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#58: Provide Compensatory Mitigation for Impacts on Waterfowl, Shorebird, and Sandhill Crane Habitat BIO-MM#80: Minimize Permanent Intermittent Noise, Visual, and Train Strike Impacts on Wildlife Movement	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Operations	All Alternatives: Impact BIO#46: Intermittent Visual Disturbance of Wildlife Using Corridors during Operations	BIO-MM#58: Provide Compensatory Mitigation for Impacts on Waterfowl, Shorebird, and Sandhill Crane Habitat BIO-MM#80: Minimize Permanent Intermittent Noise and Visual Impacts on Wildlife Movement	Less than Significant
Operations	All Alternatives: Impact BIO#47: Intermittent and Permanent Lighting Disturbance of Wildlife and Wildlife Using Corridors during Operations	BIO-MM#80: Minimize Permanent Intermittent Noise, Visual, and Train Strike Impacts on Wildlife Movement BIO-MM#89: Minimize the Impacts of Operational Lighting on Wildlife Species	Less than Significant
Operations	All Alternatives: Impact BIO#48: Mortality Resulting from Train Strike during Operations	BIO-MM#77a: Design Wildlife Crossings to Facilitate Wildlife Movement BIO-MM#80: Minimize Permanent Intermittent Noise, Visual, and Train Strike Impacts on Wildlife Movement BIO-MM#81: Minimize Permanent Intermittent Impacts on Terrestrial Species Wildlife Movement BIO-MM#82: Minimize Permanent Intermittent Impacts on Aerial Species Wildlife Movement BIO-MM#83: Implement Removal of Carrion that May Attract Condors and Eagles	Less than Significant
Operations	All Alternatives: Impact BIO#49: Injury and Mortality Resulting from Power Line Strike during Operations	BIO-MM#80: Minimize Permanent Intermittent Noise and Visual Impacts on Wildlife Movement BIO-MM#82: Minimize Permanent Intermittent Impacts on Aerial Species Movement	Less than Significant
Construction	All Alternatives: Impact BIO#51: Permanent Conversion or Degradation of Conservation Areas	BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#79a: Provide Wildlife Movement between the Santa Cruz Mountains and Diablo Range BIO-MM#84a: Avoid and Minimize Impacts on Conservation Areas BIO-MM#84b: Provide Compensatory Mitigation for Impacts on Conservation Areas	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Operations	All Alternatives: Impact BIO#53: Conflict with Santa Clara Valley Habitat Plan	BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#79a: Provide Wildlife Movement between the Santa Cruz Mountains and Diablo Range BIO-MM#84a: Avoid and Minimize Impacts on Conservation Areas BIO-MM#84b: Provide Compensatory Mitigation for Impacts on Conservation Areas BIO-MM#85: Provide Compensatory Mitigation for Permanent Impacts on California Sycamore Woodland at the Pacheco Creek Open Space Regional Reserve	Less than Significant
Operations	All Alternatives: Impact BIO#55: Conflict with Coyote Valley Linkage	BIO-MM#77a: Design Wildlife Crossings to Facilitate Wildlife Movement BIO-MM#77b: Monitoring and Adaptive Management of Wildlife Crossings BIO-MM#79a: Provide Wildlife Movement between the Santa Cruz Mountains and Diablo Range	Less than Significant
Hydrology and Water Resources			
Surface Water Quality			
Construction	All Alternatives: Impact HYD#4: Temporary Impacts on Surface Water Quality during Construction	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Non-Disturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#25: Prepare Plan for Dewatering and Water Diversions BIO-MM#71: Restore Temporary Riparian Habitat Impacts BIO-MM#73: Restore Aquatic Resources Subject to Temporary Impacts BIO-MM#74: Prepare and Implement a Compensatory Mitigation Plan (CMP) for Impacts to Aquatic Resources	Less than Significant
Construction	All Alternatives: Impact HYD#5: Permanent Impacts on Surface Water Quality during Construction	BIO-MM#72: Provide Compensatory Mitigation for Permanent Impacts on Riparian Habitat BIO-MM#74: Prepare and Implement a Compensatory Mitigation Plan (CMP) for Impacts to Aquatic Resources	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Groundwater			
Construction	All Alternatives: Impact HYD#10: Temporary Impacts on Groundwater and Surface Water Hydrology during Tunnel Construction	HYD-MM#1: Prepare and Implement a Groundwater Adaptive Management and Monitoring Program	Less than Significant
Floodplains			
Construction	Alternative 3: Impact HYD#15: Permanent Impacts on Floodplain Hydraulics during Construction	HYD-MM#2: Maintain Existing 100-year Water Surface Elevations of the Llagas Creek Floodway near Holsclaw Road in East Gilroy	Less than Significant
Hazardous Materials and Waste			
Construction	All Alternatives: Impact HMW#12: Intermittent Impacts from Hazardous Materials and Wastes Activities near Schools during Construction	HMW-MM#1: Limit use of extremely hazardous materials near schools during construction.	Less than Significant
Safety and Security			
Construction	All Alternatives: Impact S&S#1: Temporary Impacts on Emergency Access and Response Times from Temporary Roadway and Highway Closures, Relocations, and Modifications	SS-MM#1: Construct Permanent Access Roads and Driveways for Alternative 2 Skyway Drive Variant B. SS-MM#2: Construct Temporary Access Roads and Driveways for Morgan Hill Charter School (Alternatives 1 and 2) SS-MM#3: Install Emergency Vehicle Detection	Less than Significant
Operations	Alternatives 1, 2, and 3: Impact S&S#3: Permanent Impacts on Emergency Access and Response Times from Permanent Roadway and Highway Closures, Relocations, and Modifications	SS-MM#3: Install Emergency Vehicle Detection	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Operations	All Alternatives: Impact S&S#4: Continuous Permanent Impacts on Emergency Access and Response Times	SS-MM#3: Install Emergency Vehicle Detection (Alternatives 1, 2, and 3) SS-MM#4: Install Emergency Vehicle Response Improvements (Alternatives 1, 2, and 3 in part; Alternative 4 in full) In addition, for Alternative 4: TR-MM#1e: Monterey Road/Chynoweth Avenue-Roeder Road—Widen and Reconfigure TR-MM#1t: Monterey Road/San Martin Avenue—Restripe Southbound Approach TR-MM#1u: Monterey Road/IOOF Avenue—Widen and Reconfigure Southbound Approach TR-MM#1w: Chestnut Street/Luchessa Street—Reconfigure Southbound Approach TR-MM#1x.6: East Main Avenue/Depot Street—Install Traffic Signal TR-MM#1x.8: Llagas Road/San Martin Avenue—Install Traffic Signal TR-MM#1x.9: School Access/IOOF Avenue—Install Traffic Signal TR-MM#1x.10: SR 25/Bloomfield—Install Traffic Signal	Less than Significant for Alternatives 1, 2 and 3 Significant and Unavoidable for Alternative 4 Travel times are impacted at the following locations: Monterey Corridor Fire Stations: ▪ 4430 Monterey Road Morgan Hill and Gilroy Fire Stations: ▪ 15670 Monterey Road ▪ 10810 No Name Uno ▪ 880 Sunrise Drive ▪ 8383 Wren Avenue ▪ 7070 Chestnut Street
Station Planning, Land Use, and Development			
Construction	Alternative 3: Impact LU#4: Permanent Alteration of Land Use Patterns from Land Use Conversion and Introduction of Incompatible Uses	No mitigation has been identified.	Significant and Unavoidable
Agricultural Farmlands			
Construction	All Alternatives: Impact AG#2: Permanent Conversion of Important Farmland to Nonagricultural Use	AG-MM#1: Conserve Important Farmland (Prime Farmland, Farmland of Statewide Importance, Farmland of Local Importance, and Unique Farmland) AG-MM#2: Minimize the Area of Important Farmland (Prime Farmland, Farmland of Statewide Importance, Farmland of Local Importance, and Unique Farmland) Required for HSR Guideway	Significant and Unavoidable

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Construction	All Alternatives: Impact AG#3: Permanent Creation of Remnant Parcels of Important Farmland	AG-MM#1: Conserve Important Farmland (Prime Farmland, Farmland of Statewide Importance, Farmland of Local Importance, and Unique Farmland) AG-MM#2: Minimize the Area of Important Farmland (Prime Farmland, Farmland of Statewide Importance, Farmland of Local Importance, and Unique Farmland) Required for HSR Guideway AG-MM#3: Evaluate Modified Access to Remnant Parcels with Landowner Input	Significant and Unavoidable
Construction	All Alternatives: Impact AG#4: Temporary Disruption of Agricultural Infrastructure Serving Important Farmland	AG-MM#4: Relocate and Reconnect Drainage Facilities before Disconnecting Original Facilities	Less than Significant
Construction	All Alternatives: Impact AG#5: Permanent Disruption of Agricultural Infrastructure Serving Important Farmland	AG-MM#4: Relocate and Reconnect Drainage Facilities before Disconnecting Original Facilities AG-MM#5: Avoid Infrastructure Serving Important Farmland from Station 3148+60 to Station 3154 (near Casa de Fruta)	Less than Significant
Parks, Recreation, and Open Space			
Construction	Alternatives 2 and 4: Impact PK#1: Temporary Changes from Noise, Vibration, and Construction Emissions on Use and User Experience of Parks, Recreational Facilities, and Open Space Resources	NV-MM #1: Construction Noise Mitigation Measures NV-MM#2: Construction Vibration Mitigation Measures PR-MM#6: Minimize Construction Noise Impacts During Noise Sensitive Special Events	Less than Significant
Construction	All Alternatives: Impact PK#2: Temporary Changes to Access or Use of Parks	PR-MM#1: Provide Access to Trails during Construction PR-MM#2: Provide Temporary Park Access PR-MM#4: Implement Project Design Features PR-MM#7: Design Refinements to Avoid Aboveground Park Encroachment at Tamien Park (Alts. 1–3) PR-MM#8: Reconfigure Reed and Grant Streets Sports Park (Alts. 2, 3)	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Construction	All Alternatives: Impact PK#4: Permanent Changes Affecting Access to or Circulation in Parks, Recreational Facilities, and Open Space Resources	PR-MM#3: Provide Permanent Park Access	Less than Significant
Construction	All Alternatives: Impact PK#6: Permanent Acquisition of Parks, Recreation, and Open Space Resources	PR-MM#3: Provide Permanent Park Access PR-MM#5: Implement Measures to Reduce Impacts Associated with the Relocation of Important Facilities PR-MM#7: Design Refinements to Avoid Aboveground Park Encroachment at Tamien Park PR-MM#8: Reconfigure Reed and Grant Streets Sports Park (Alts. 2, 3)	Less than Significant
Operations	All Alternatives: Impact PK#7: Permanent Changes from Noise and Vibration on Parks, Recreation, and Open Space Resource Character and Use	NV-MM#3: Implement Proposed California High-Speed Rail Project Noise Mitigation Guidelines NV-MM#4: Support Potential Implementation of Quiet Zones by Local Jurisdictions NV-MM#8: Project Vibration Mitigation Measures BIO-MM#80: Minimize Permanent Intermittent Noise, Visual, and Train Strike Impacts on Wildlife Movement	Less than Significant
School District Play Areas			
Construction	Alternative 2: Impact PK#14: Permanent Acquisition of School District Play Areas	PR-MM#5: Implement Measures to Reduce Impacts Associated with the Relocation of Important Facilities	Significant and Unavoidable
Operations	Alternative 4: Impact PK#15: Permanent Changes from Noise and Vibration on School District Play Area Character and Use	NV-MM#3: Implement Proposed California High-Speed Rail Project Noise Mitigation Guidelines NV-MM#4: Support Potential Implementation of Quiet Zones by Local Jurisdictions	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Aesthetics and Visual Quality			
Visual Quality, Including Scenic Vistas			
Construction	All Alternatives: Impact AVQ#1: Temporary Direct Impacts on Visual Quality and Scenic Vistas	AVQ-MM#1: Minimize Visual Disruption from Construction Activities AVQ-MM#2: Minimize Light Disturbance during Construction	Less than Significant
Construction	Alternatives 1, 2, and 3: Impact AVQ#5: Permanent Direct Impacts on Visual Quality—Communications Hill Landscape Unit	AVQ-MM#4: Provide Vegetation Screening along At-Grade and Elevated Guideways Adjacent to Residential Areas AVQ-MM#5: Replant Unused Portions of Lands Acquired for the HSR	Less than Significant
Construction	Alternatives 1 and 3: Impact AVQ#6: Permanent Direct Impacts on Visual Quality—Monterey Highway San Jose Landscape Unit	AVQ-MM#3: Incorporate Design Aesthetic Preferences into Final Design and Construction of Non-Station Structures AVQ-MM#4: Provide Vegetation Screening along At-Grade and Elevated Guideways Adjacent to Residential Areas	Significant and Unavoidable
Construction	Alternatives 1 and 3: Impact AVQ#7: Permanent Direct Impacts on Visual Quality—Coyote Valley Landscape Unit	No mitigation is available.	Significant and Unavoidable
Construction	Alternative 3: Impact AVQ#11: Permanent Direct Impacts on Visual Quality—Pajaro–San Felipe Landscape Unit	AVQ-MM#3: Incorporate Design Aesthetic Preferences into Final Design and Construction of Non-Station Structures AVQ-MM#4: Provide Vegetation Screening along At-Grade and Elevated Guideways Adjacent to Residential Areas AVQ-MM#5: Replant Unused Portions of Lands Acquired for the HSR	Significant and Unavoidable
Construction	Alternative 3: Impact AVQ#16: Indirect Impacts on Visual Quality from HSR Stations	No mitigation is available.	Significant and Unavoidable

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Light and Glare			
Construction	All Alternatives: Impact AVQ#18: Temporary Direct Impacts on Nighttime Light Levels	AVQ-MM#1: Minimize Visual Disruption from Construction Activities AVQ-MM#2: Minimize Light Disturbance during Construction	Less than Significant
Construction	Alternatives 1, 2, and 4: Impact AVQ#19: Permanent Direct Impacts on Nighttime Light Levels at Fixed Locations	AVQ-MM#6: Screen Traction Power Distribution Stations and Radio Communication Towers AVQ-MM#4: Provide Vegetation Screening along At-Grade and Elevated Guideways Adjacent to Residential Areas	Significant and Unavoidable
Construction	Alternatives 1, 2, and 3: Impact AVQ#20: Permanent Direct Impacts on Nighttime Light Levels from Trains	AVQ-MM#4: Provide Vegetation Screening along At-Grade and Elevated Guideways Adjacent to Residential Areas NV-MM#3: Implement Proposed California High-Speed Rail Project Noise Mitigation Guidelines	Significant and Unavoidable
Cultural Resources			
Construction	All Alternatives: Impact CUL#1: Permanent Disturbance of Unknown Archaeological Sites	CUL-MM#1: Mitigate Adverse Effects to Archaeological and Built Environment Resources Identified during Phased Identification and Comply with the Stipulations Regarding the Treatment of Archaeological and Built Resources in the PA and MOA CUL-MM#2: Halt Work in the Event of an Archaeological Discovery, and Comply with the PA, MOA, ATP, and all State and Federal Laws, as Applicable CUL-MM#3: Other Mitigation for Effects on Pre-Contact Archaeological Sites	Less than Significant
Construction	All Alternatives: Impact CUL#2: Permanent Disturbance of a Known Archaeological Site	CUL-MM#1: Mitigate Adverse Effects on Archaeological and Built Environment Resources Identified during Phased Identification and Comply with the Stipulations Regarding the Treatment of Archaeological and Built Resources in the PA and MOA CUL-MM#2: Halt Work in the Event of an Archaeological Discovery, and Comply with the PA, MOA, ATP, and all State and Federal Laws, as Applicable CUL-MM#3: Other Mitigation for Effects on Pre-Contact Archaeological Sites	Less than Significant

Resource Category	Significant (CEQA) Impacts before Mitigation[1]	Summary of Mitigation Measures	CEQA Level of Significance after Mitigation[2]
Construction	All Alternatives: Impact CUL#4: Permanent Demolition, Destruction, Relocation, or Alteration of Built Resources or Setting	CUL-MM#1: Mitigate Adverse Effects on Archaeological and Built Environment Resources Identified during Phased Identification and Comply with the Stipulations Regarding the Treatment of Archaeological and Built Resources in the PA and MOA CUL-MM#4: Relocate Historic Buildings and Structures CUL-MM#6: Prepare and Submit Additional Recordation and Documentation CUL-MM#7: Prepare Interpretive or Educational Materials CUL-MM#10: Station Design Consistent with the Secretary of the Interior's Standards for the Treatment of Historic Properties CUL-MM#11: Relocate Automatic Train Control Site to Avoid Demolition of 415 Illinois Avenue (Alternatives 1, 2, and 3)	Significant and Unavoidable

[1] The determination before mitigation for the consideration of cumulative impacts is cumulatively significant.
[2] The determination after mitigation would be either cumulatively considerable or not cumulatively considerable under the California Environmental Quality Act.
[3] The analysis of construction emissions for the project alternatives is based upon a fleet average mix of engine tier standards (i.e. Tiers 1–4). Subsequent to the preparation of the analysis, the Authority implemented a new mandate for all construction contractors to use construction equipment that meets the more stringent Tier 4 standards. As such, the analysis as prepared represents a conservative estimate of emissions using the EMFAC 2017 model.
[4] While AQ-MM#3 and AQ-MM#4 will offset VOC, NOx, and PM emissions, as required, these offsets could occur regionally throughout the SFBAAB and SJVAPCD. Accordingly, the emission reductions achieved by these offsets may not contribute to enough localized reductions to avoid a project-level violation of the ambient air quality standards or significant impact levels.
ATP = archaeological treatment plan
CEQA = California Environmental Quality Act
CO = carbon monoxide
HSR = high-speed rail
MOA = Memorandum of Agreement
NCCAB = North Central Coast Air Basin
NO_x = nitrogen oxide
PA = Programmatic Agreement
PM_{10} = particulate matter with diameter of 10 microns or less
SCRWA = South County Regional Water Agency
SFBAAB = San Francisco Bay Area Air Basin
SJVAB = San Joaquin Valley Air Basin
WWTP = wastewater treatment plant

Table S-6 Significant and Unavoidable Impacts by Alternative

Alternative	Number of Significant and Unavoidable Impacts
Alternative 1	14
Alternative 2	13
Alternative 3	16
Alternative 4	10

S.8.7 Capital and Operations Cost

The costs reflect the total labor and materials for each of the project alternatives in 2018 dollars. The estimates are for common HSR elements and construction methods. The capital cost estimates include the total labor effort and materials to construct the project, including utility relocations and modifications to roadways required to accommodate the HSR alternatives. For consistency with the environmental impact analysis, the estimated operations and maintenance costs are based upon the Authority's 2016 Business Plan.[6] For additional information, see Chapter 6 in the Final EIR/EIS. The total estimated capital costs for each alternative are presented in Table S-7. The 2018 Business Plan updated the O&M cost model with the latest available information on socioeconomic forecasts, transit network plans, auto travel time, auto operating costs, parking costs, and operations planning (reflecting updated trip times, station assumptions and frequency and patterns of service). In 2029, revenue would exceed annual O&M costs by $584 million, while by 2040 revenues would exceed annual O&M costs by $1,427 million (2017$) (Authority 2018).

Table S-7 Capital Cost by Alternative *(2021$ millions)*

Alternative[1]	Cost
Alternative 1	$28,334
Alternative 2[2]	$25,079
Alternative 3	$28,698
Alternative 4	$18,993

Note: Costs are rounded to the nearest million dollars

[1] The capital costs for all four alternatives include the costs associated with the tunnel design variant. The capital costs for Alternative 4 also include the costs associated with the Diridon design variant.

[2] Skyway Variant A and B under Alternative 2 would have the same cost.

S.9 Section 4(f) and Section 6(f)

S.9.1 Section 4(f)

Under Section 4(f) of the U.S. Department of Transportation Act (codified at 49 U.S.C. § 303), an operating administration of the U.S. Department of Transportation may not approve a project that uses properties protected under this section of the law unless there are no prudent or feasible avoidance alternatives and the project includes all possible planning to minimize harm to such properties. Properties protected under Section 4(f) are publicly owned lands of a park, recreation area, or wildlife and waterfowl refuge or land of a historical site (publicly or privately owned) of

[6] The Authority's 2018 Business Plan, adopted in June 2018, includes updated O&M costs. As stated in that plan "Operations and maintenance costs in all scenarios are minimally impacted by the changes made since the 2016 Business Plan" (2018 Business Plan, Chapter 7, p. 96.).

national, state, or local significance as determined by the federal, state, regional, or local officials having jurisdiction over the resource.

There are 84 Section 4(f) properties in the RSAs for recreational and cultural resources: 49 parks and recreation lands and wildlife and waterfowl refuges, and 35 historical properties.

What are Section 4(f) properties?

Section 4(f) properties are publicly owned lands of parks, recreation areas, or wildlife and waterfowl refuges or publicly or privately owned lands of national, state, or local significance. Historic properties on or eligible for listing on the National Register of Historic Places may also qualify for protections under Section 4(f). A project that uses Section 4(f) properties may not be approved unless there are no prudent or feasible alternatives and the project includes all possible planning to minimize harm to such properties.

Overall, Alternative 4 would affect the fewest Section 4(f) resources (8), compared to Alternative 1 (11), Alternative 3 (12), and Alternative 2 (16). Alternative 4 would affect the fewest park, recreation, and open-space resources (three), compared to eight resources under Alternative 2, seven resources under Alternative 3, and five resources under Alternative 1. All impacts to parks, recreation, and open-space resources would be *de minimis* with the exception of temporary occupancy and permanent use of a portion of the Coyote Creek Parkway County Park (Alternative 4 would have the lowest effects to this park) and a temporary occupancy at the Field Sports County Park (all alternatives would have the same temporary effect). No feasible and prudent alternatives are available to avoid these uses and measures to minimize harm are included in the project to address project alternatives' effects on these two parks. The severity of the other impacts on park, recreation, and open-space resources would be similar under all project alternatives. Mitigation measures that are applicable to Section 4(f) resources include: AVQ-MM#3, AVQ-MM#4, AVQ-MM#6, NV-MM#3, NV-MM#4, NV-MM#5, NV-MM#6, NV-MM#7, PR-MM#1, PR-MM#2, PR-MM#4, PR-MM#7, BIO-MM#9, BIO-MM#77a, and HYD-MM#1.

Regarding historic properties, all four project alternatives would result in the direct use and demolition of resources or contributing features to resources: Southern Pacific Depot (Diridon Station/Hiram Cahill Depot) and Cozzi Family Property. Impacts on these two properties are the same under all project alternatives, and thus are not differentiating factors among the project alternatives. In total, Alternative 1 would result in uses of six cultural resources (five permanent uses and one *de minimis*), Alternative 2 would result in uses of eight cultural resources (eight permanent uses and none *de minimis*), Alternative 3 would result in uses of five cultural resources (four permanent uses and one *de minimis*), and Alternative 4 would result in uses of five cultural resources (four permanent uses and one *de minimis*).

The Authority is continuing coordination, as appropriate, with the SHPO. During final design, additional measures to minimize harm may be agreed on to further reduce potential impacts on Section 4(f) properties. For additional information, see Chapter 4.

S.9.2 Section 6(f)

Section 6(f) properties are recreation resources funded by the federal Land and Water Conservation Fund Act (LWCF) Act. These properties also cannot be used for transportation projects unless there is no prudent or feasible alternative, and their use must be fully mitigated to the satisfaction of the National Park Service and the local jurisdiction administering the recreation resource.

There are four Section 6(f) properties within the RSA: Guadalupe River Park, Guadalupe Gardens (part of Guadalupe River Park), San Luis Dinosaur Development (part of San Luis Reservoir State Recreation Area), and the Cottonwood Creek Wildlife Area (NPS 2016). The project alternatives would not require permanent or temporary acquisition of land from any of the Section 6(f) properties. In addition, construction activities would not occur within any of the resources. While construction of the tunnel underneath Cottonwood Creek Wildlife Area may result in the lowering of groundwater due to tunnel inflows, mitigation measures BIO-MM#9 and HYD-MM#1 will avoid affecting wildlife function. Therefore, no impacts on Section 6(f) resources would occur.

S.10 Environmental Justice

Environmental justice in terms of transportation projects can be defined as the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, from the early stages of transportation planning and investment decision-making through construction, operations, and maintenance. The process must have evaluated, to the extent practicable and permitted by law, the potential disproportionately high adverse human health and environmental impacts of their programs, policies, and activities on minority populations and low-income populations (also referred to as environmental justice communities in this EIR/EIS). A disproportionately high and adverse effect on minority populations and low-income populations is generally defined as an effect that:

- Would be predominantly borne by minority populations or low-income populations, or
- Would be suffered by minority populations and low-income populations and would be appreciably more severe or greater in magnitude than the adverse effect suffered by the non-low-income populations and non-minority populations in the affected area and the reference community.

The project alternatives would result in local and regional benefits to the low-income populations and minority populations that constitute a large percentage of the reference community. These benefits would include improvements in mobility within the region, air quality improvements, and new employment opportunities during construction and operations, among other benefits.

Laws and Regulations that Govern Environmental Justice:

- Title VI of the Civil Rights Act (Public Law 88-352)
- Presidential Executive Order (USEO) 12898, known as the Federal Environmental Justice Policy and the Presidential Memorandum accompanying USEO 12898
- Improving Access to Services for Persons with Limited English Proficiency (USEO 13166)
- U.S. Department of Transportation Order 5610.2C, which updates the original Environmental Justice Order
- The CEQ's Environmental Justice Guidance under NEPA (CEQ 1997)
- Americans with Disabilities Act (42 U.S.C. § 12101 et seq.)
- Uniform Relocation Assistance and Real Property Program (42 U.S.C. § 4601 et seq.)
- California Government Code Section 65040.12(e)
- California *Global Warming Solutions Act of 2006: Greenhouse Gas Reduction Fund (Assembly Bill 32, Chapter 488, Statutes of 2006)*

Additionally, the Authority's Title VI policy and plan and a Limited English Proficiency policy and plan address the Authority's commitment to nondiscrimination on the basis of race, color, national origin, age, sex, or disability and to providing language assistance to individuals with limited English proficiency.

The design of the project alternatives would minimize or avoid impacts related to health risks associated with EMF and EMI; geology, soils, seismicity and paleontological resources; biological and aquatic resources; water quality; floodplains; station planning, land use, and development; agricultural farmland; and cultural resources. Impacts under these resource topics do not have the potential to adversely affect environmental justice communities (see discussion of these resource topics in Chapter 5, Environmental Justice, in the Final EIR/EIS for more information).

Project effects associated with construction noise and vibration, temporary construction-related effects on aesthetics and visual quality, emergency response delay during construction, residential displacements (except for Alternative 2), park acquisitions (except for Alternative 2), and vibration were determined to have adverse effects on environmental justice communities that would be addressed through mitigation. For these resource topics, the proposed mitigation would be applied equally to minority populations, low-income populations, and the general population and was responsive to the concerns raised during the environmental justice engagement process, and, after mitigation, these resource topics do not have the potential to have a disproportionately high and adverse effect on environmental justice communities.

Project effects associated with construction traffic, construction delay of bus transit, operational traffic, and business displacements were determined to have adverse effects on environmental

justice communities that would be addressed through mitigation and offset through the positive transportation and economic benefits of the project that would be experienced by the populations affected by the adverse effects for these resource topics. For these resource topics, the proposed mitigation would be applied equally and the project benefits would be available equally to minority populations, low-income populations, and the general population and was responsive to the concerns raised during the environmental justice engagement process, and, after mitigation and consideration of project benefits, these resource topics do not have the potential to have a disproportionately high and adverse effect on environmental justice communities.

Before consideration of offsetting mitigation measures, the project alternatives would result in disproportionately high and adverse effects on low-income populations and minority populations residing along the project corridor from operational aesthetics and visual quality changes (Alternatives 1, 2, and 3), residential displacement (Alternative 2), emergency vehicle response delay (Alternative 4), loss of school district play areas (Alternative 2), and operational noise (all alternatives). A series of offsetting mitigation measures (consisting of certain community improvements) was developed through an interactive planning and engagement process involving local environmental justice communities to help offset these residual effects. With implementation of direct mitigation, consideration of project benefits, and the proposed offsetting mitigation measures for each project alternative, some, but not all, of the residual effects would be offset, and the concerns raised during the environmental justice process would be addressed. Alternatives 1 and 3 would have residual disproportionately high and adverse effects on environmental justice communities related to aesthetics and visual quality due to the extensive areas of an elevated viaduct within those communities. Alternative 2 would have residual disproportionately high and adverse effects on environmental justice communities related to aesthetics and visual quality due to extensive areas of elevated embankment (including large grade separations) within those communities and related to the acquisition of a portion of the South Valley Middle School track and field in Gilroy. With implementation of direct mitigation, consideration of project benefits, and the proposed offsetting mitigation measures Alternative 4 would not have any residual disproportionately high and adverse effects on environmental justice communities.

S.11 Areas of Controversy

Based upon the public outreach efforts throughout the environmental review process, the following are known areas of controversy associated with the project alternatives:

- Consultation and outreach
- Business Plan (funding, ridership, and schedule)
- Right-of-way acquisition and planning
- Project operations (hours of operation, frequency, and speed)
- Alternatives feasibility
- Traffic impacts
- Impacts on wildlife
- Impacts on agricultural lands
- Noise and vibration impacts

S.12 Environmental Process

The Authority is releasing the Final EIR/EIS to affected local jurisdictions, state and federal agencies, tribes, community organizations, other interest groups, interested individuals, and the public. The document also is available at the Authority offices, public libraries in the vicinity of the San Jose to Merced Project Section, and on the Authority's website. The following discussion outlines the next steps in the environmental process.

S.12.1 Identification of Preferred Alternative

The Authority identified Alternative 4, including the DDV and TDV, as the Preferred Alternative for the San Jose to Central Valley Wye Project Extent. The Authority identified this alternative on the basis of a balanced consideration of the environmental information presented in the Final EIR/EIS in the context of Purpose and Need; project objectives; CEQA, NEPA, and CWA Section 404(b)(1) requirements; local and regional land use plans; community preferences; and costs.

Preferred Alternative

The *Preferred Alternative* is the alternative identified as preferred by the lead agency.

For the San Jose to Central Valley Wye Project, Alternative 4 is the Preferred Alternative, including the DDV and the TDV.

The identification of the Preferred Alternative is also based upon evaluation of Section 4(f) of the Department of Transportation Act (49 U.S.C. § 303) (Section 4(f)), which provides special protection to publicly owned public parks; recreational areas of national, state, or local significance; wildlife or waterfowl refuges; and lands of a historic site of national, state, or local significance. Section 4(f) properties can only be used by federally funded transportation projects if there is no feasible and prudent avoidance alternative and all possible planning has been taken to minimize harm to any 4(f) property used by the project.

The Preferred Alternative is estimated to cost approximately $19 billion (in 2021 dollars). It has the lowest capital cost of the four project alternatives.

This section describes how the Authority identified the Preferred Alternative that the agency believes would fulfill its statutory missions and responsibilities by giving consideration to economic, environmental, technical, and other evaluation factors. The Authority identified the Preferred Alternative by balancing the adverse and beneficial impacts of the project on the human and natural environment. Taking this holistic approach means that no single issue was dispositive in identifying the Preferred Alternative in any given geographic area. The Authority weighed all the issues—including natural resource and community impacts, the input of the communities along the project alignment, the views of federal and state resource agencies, project costs, and constructability—to identify what the Authority believes is the best alternative to achieve the project's Purpose and Need.

Table S-8 shows the potential impacts of the project alternatives on community factors (displacements, agricultural farmlands, aesthetics and visual quality, land use and development, noise, traffic,[7] emergency vehicle access/response time, environmental justice) and environmental factors (biological resources, Section 4(f)/6(f) resources, built environment historic resources, and natural resources). The impacts shown in Table S-8 include relevant and applicable mitigation. The best performing alternative is indicated with bold text and an asterisk (*).

[7] In accordance with Senate Bill 743 (2013) and the CEQA Guideline Updates (December 2018), the Authority does not consider traffic vehicle delay, measured through level of service (LOS) or other metrics, to be a CEQA significant impact. The Authority's approach to CEQA is the same approach currently used by the City of San Jose, the City of San Francisco, and other jurisdictions. This approach is allowed by the current CEQA Guidelines and became mandatory for all CEQA lead agencies in California as of July 1, 2020.

Table S-8 Comparison of Key Resource Factors by Project Alternative

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Community Factors[1]				
Displacements				
Residential displacements (number of units)	147	603	157	**68***
Commercial displacements (number of businesses)	217	348	157	**66*** (68)
Agricultural displacements (number of structural improvements)	49	53	49	**40***
Community or public facilities displacement (number of units)	7	8	5	**1***
Commercial displacements (square feet)	**411,000***	1,800,000	994,000	448,000 (463,120)
Agricultural structure displacements (square feet)	**407,000***	1,206,000	1,489,000	542,000
Agricultural Farmland				
Permanent conversion of Important Farmland[2] (acres)	1,036	1,181	1,193	**1,033**
Aesthetics and Visual Quality				
Visual quality impacts	Viaduct Elevated Stations	Embankment and Viaduct Elevated Stations Roadway Grade Separations	Viaduct Elevated Stations Alignment in Rural Area (East Gilroy)	**At-grade alignment Existing Right-of-Way***
Land Use and Development				
Consistency with City of Gilroy General Plan policy encouraging Transit-Oriented Development in downtown station area	**Yes***	**Yes***	No	**Yes***
Noise				
Severe noise impacts with noise barrier mitigation (number of sensitive receptors)	232 (242)	195 (206)	**174*** (185)	291 (303)
Severe noise impacts with noise barrier mitigation and if local municipalities implement quiet zones[3] (number of sensitive receptors)	224 (234)	195 (206)	**174*** (185)	192 (205)

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Vibration				
Vibration impacts	**81* permanent vibration impacts (before mitigation); potential to reduce all or most of these impacts to below the threshold with mitigation.**	143 permanent vibration impacts (before mitigation); potential to reduce all or most of these impacts to below the threshold with mitigation.	140 permanent vibration impacts (before mitigation); potential to reduce all or most of these impacts to below the threshold with mitigation.	1,203 permanent vibration impacts (before mitigation); potential to reduce all but 15 of these impacts to below the threshold with mitigation.
Traffic				
Permanent road closures – San Jose to Gilroy	10	21	9	**7***
Permanent road closures – Gilroy to Carlucci Road	**8***			
Intersections with adverse NEPA effects after mitigation	23	24	23	**22***
Emergency Vehicle Access/Response Time				
Areas of potential delay to emergency vehicle response times	**Monterey Corridor due to Monterey Road narrowing***			Monterey Corridor, Morgan Hill, Gilroy due to gate-down time
Types of mitigation needed to minimize emergency vehicle delays	**Vehicle detection equipment***			Vehicle detection equipment, additional emergency equipment for existing fire stations, new fire stations, and potentially additional ambulance services
Comparative level of increase on fire department response times (lower number is less delay)	**1***	3	**1***	4
Environmental Justice (EJ) [4]				
Disproportionately high and adverse effects due to disruption of traffic or transit during construction on minority populations or low-income populations	No	No	No	**No***

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Disproportionately high and adverse effects on operational traffic on minority populations or low-income populations	No	No	No	**No***
Disproportionately high and adverse effects on local views associated with the viaduct or elevated embankment on minority populations or low-income populations	Yes	Yes	Yes	**No***
Disproportionately high and adverse residential displacements to minority populations or low-income populations	No	No	No	**No***
Disproportionately high and adverse business displacements to minority populations or low-income populations	No	No	**No***	No
Disproportionately high and adverse effects due to emergency vehicle response time delays on minority populations or low-income populations	No	No	**No***	No
Disproportionately high and adverse effect on parks on minority populations or low-income populations	No	Yes	**No***	No
Disproportionately high and adverse severe noise impacts on minority populations or low-income populations[5]	**No***	No	No	No
Environmental Factors[1]				
Biological Resources				
Permanent impacts on jurisdictional waters and wetlands (acres)	101	108	111	**97***
Permanent impacts on habitat for special-status plant species (non-overlapping acres)	1,179	1,186	1,191	**1,154***
Permanent impacts on habitat for listed wildlife species with the most impacts overall (California tiger salamander, acres)	2,249	2,305	2,448	**2,126***

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Wildlife corridor impacts	**Avoids east Gilroy; fewer Soap Lake floodplain impacts***	**Avoids east Gilroy; fewer Soap Lake floodplain impacts***	Impacts in east Gilroy; more impacts in Soap Lake floodplain	**Avoids east Gilroy; fewer Soap Lake floodplain impacts***
Permanent impacts on conservation areas (acres)	**427***	432	481	**427***
Section 4(f)/6(f) Resources				
Permanent use of 4(f)/6(f) park resources (number of resources [acres], includes resources with *de minimis* impact)	4 (4.8)	7 (8.3)	6 (5.8)	**2 (0.3)***
Temporary use of 4(f)/6(f) park resources (number of resources [acres])	1 (2.04)	1 (2.04)	1 (2.04)	1 (2.04)
Permanent use of 4(f) historic property resources (number of resources, includes resources with *de minimis* impact)[6]	6	8	5	**5**
Built Environment Historic Resources				
Number of permanent adverse impacts on NRHP-listed/eligible resources (number of resources)	7	11	7	**5***
Number of permanent significant impacts on CEQA-only historic resources (number of resources)	2	4	**1***	**1***

Note: The best performing alternatives are indicated with bold text and an asterisk (*).
[1] Community and environmental factors affected by the DDV (which applies to Alternative 4 only) and the TDV (which applies to all alternatives) are shown in parentheses.
[2] Important Farmland includes Prime Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance.
[3] A "quiet zone" is an area in which an FRA exemption has been granted to the rule requiring trains to sound their horns when approaching public highway-rail grade crossings. A quiet zone is a section of rail line at least one-half mile in length that contains one or more consecutive public grade crossings or a single public grade crossing at which locomotive horns are not routinely sounded. Only local cities and counties can request establishment of a quiet zone through the FRA.
[4] Criteria used for evaluation are those subjects where the EIR/EIS analysis indicates disproportionately high and adverse effects on low-income populations and minority populations after direct mitigation. Conclusions take into account the effect of direct mitigation, the offsetting value of project benefits, and offsetting mitigation measures proposed for each project alternative.
[5] Noise impacts after noise barrier mitigation.
[6] Determinations regarding use of historic properties under Section 4(f) are not synonymous with findings of adverse effect to historic properties per Section 106. See analysis in Chapter 4.
AM = morning
NB = Northbound
NRHP = National Register of Historic Places
PM = evening
SB = southbound
SF = square feet

The Authority staff identified Alternative 4 as the Preferred Alternative in June 2019, based upon the analysis contained in the Draft EIR/EIS, the evaluation in this chapter, and the input received from the public; local, state, and federal agencies; businesses; tribes; and community organizations. Alternative 4 includes the San Jose Diridon Station, a station in downtown Gilroy, along with the South Gilroy MOWF. Subsequent public outreach meetings were held in July and August 2019 to solicit input on the Preferred Alternative. HSR staff presented a report to the Authority Board of Directors at its September 17, 2019, meeting that summarized information on the project alternatives and public, agency, and other stakeholder input. The Board of Directors considered the staff report and input from public testimony at the September 17, 2019 meeting and concurred with the identification of Alternative 4 as the Preferred Alternative for the San Jose to Central Valley Wye Project Extent. As part of ongoing design optimization, Authority staff identified design variants for Diridon (applicable to Alternative 4 only) and the tunnels (applicable to all alternatives) to optimize speeds.

S.13 Next Steps in the Environmental Process

S.13.1 California High-Speed Rail Authority Decision-Making

After completion of the environmental process, the Authority will consider whether to certify this Final EIR/EIS for compliance with CEQA. If the Authority certifies this Final EIR/EIS, it can consider approving one of the four alternatives and making related CEQA decisions (i.e., findings, mitigation plan, and potential statement of overriding considerations). The required CEQA findings prepared for each significant impact would be one of the following:

- Changes or alternatives have been required or incorporated into the project that avoid or substantially lessen the significant environmental impact as identified in the Final EIR.
- Changes or alternatives are within the responsibility and jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by the other agency or can and should be adopted by the other agency.
- Specific economic, legal, social, technological, or other considerations, including provision of employment opportunities for highly trained workers, make infeasible the mitigation measures or HSR alternatives identified in the Final EIR.

If the Authority proceeds with approval of the project, the Authority would file a Notice of Determination (NOD) that identifies the project and notes whether it would have a significant impact on the environment. If the Authority approves a project that would result in the occurrence of a significant impact identified in the Final EIR, but not avoided or substantially lessened, CEQA requires the preparation of a Statement of Overriding Considerations. This provides specific reasons to support the project, including economic, legal, social, technological, or other benefits of the proposed project that outweigh adverse environmental impacts. If such a statement is prepared, the Authority's NOD will reference the statement.

The environmental process under NEPA is completed with publication of a Final EIR/EIS and a Record of Decision (ROD). Pursuant to 23 U.S.C. 327 and an MOU dated July 23, 2019, FRA assigned its federal environmental review responsibilities to the Authority. The Authority is now the NEPA lead agency. As such, if the Authority proceeds with approval of the project, it will issue a ROD. The ROD would describe the project and alternatives considered, describe the selected alternative, and identify the environmentally preferable alternative; make environmental findings and determinations with regard to the Endangered Species Act, Section 106, Section 4(f), and environmental justice; present FRA's determination of air quality conformity; and identify any required mitigation measures.

S.13.2 Federal Railroad Administration Decision-Making

As established in the NEPA Assignment MOU, the FRA will make findings and determinations with regard to air quality conformity under the Clean Air Act.

S.13.3 U.S. Army Corps of Engineers Decision-Making

Construction of the project would require a permit from the USACE under Section 404 of the CWA (33 U.S.C. § 1251 et seq.). A permit under Section 10 of the Rivers and Harbors Act (33 U.S.C. § 403) would not be required because no navigable waters as defined under 33 CFR 329.4, would be crossed by the project. Permission under Section 14 of the Rivers and Harbors Act (33 U.S.C. § 408) would be required for effects on flood control facilities and floodplains. The USACE is using the Final EIR/EIS to integrate procedural and substantive requirements of NEPA and its permitting responsibilities (including the USEPA's Section 404(b)(1) Guidelines) to provide a single document that streamlines and enables informed decision-making, including, but not limited to, adoption of the EIS, issuance of necessary RODs, Section 404 permit decisions and Section 408 permission (as applicable). This single document can be used for alteration/modification of completed federal flood risk management facilities and any associated operation and maintenance, and real estate permissions or instruments (as applicable).

S.13.4 Surface Transportation Board

The Authority would seek STB permission to construct the San Jose to Merced Project Section. On completion of the environmental process and issuance of a ROD and upon request from the Authority, the STB is anticipated to issue a final decision on whether to approve the project (the final decision also serves as the STB's ROD under NEPA). No project-related construction on the Project Section may begin until the STB's final decision has been issued and has become effective.

S.13.5 Project Implementation

The anticipated dates for completion of key milestones as part of the environmental process are shown in Table S-9. After the issuance of the ROD and NOD, the Authority would complete final design, obtain construction permits, and acquire property before construction.

Table S-9 San Jose to Merced Project Section Milestone Schedule

Date	Key Milestones
April 2020	Public release of Draft EIR/EIS
February 2022	Final EIR/EIS published
April 2022	Notice of Determination and Record of Decision

1 PROJECT PURPOSE, NEED, AND OBJECTIVES

Since publication of the Draft Environmental Impact Report (EIR)/Environmental Impact Statement (EIS), the following substantive changes have been made to this chapter:

- Section 1.1.3.2, Business Plans for the Statewide High-Speed Rail System, was updated to reference ridership forecasts for 2040 in the 2020 Business Plan (Authority 2021).
- Section 1.1.3.5, Project-Level Environmental Reviews, and Section 1.1.4, The San Jose to Merced Project Section, were updated to reflect approval of the *Merced to Fresno Section: Central Valley Wye Supplemental EIR/EIS* (Authority 2020a) certification of the Final Supplemental EIR, and issuance of the Record of Decision.
- Section 1.1.3.5, Project-Level Environmental Reviews, was updated to reflect completion of the following Tier 2 EIR/EISs: Bakersfield to Palmdale Final EIR/EIS and Burbank to Los Angeles Final EIR/EIS.
- Section 1.2.4.1, Travel Demand and Capacity Constraints, and the newly inserted Section 1.3.4, Authority Agreements with the Peninsula Corridor Joint Powers Board and Other Agencies Regarding Blended Service in the Caltrain Corridor, provide updated information about Caltrain, specifically the Peninsula Corridor Joint Powers Board (PCJPB) and agreements the California High-Speed Rail Authority (Authority) has with PCJPB.
- Section 1.2.4.1; Section 1.3, Relationship to Other Agency Plans, Policies, and Programs; and Section 1.4, Relationship to Other Transportation Projects in the Study Area, were updated to reflect the current status of projects mentioned.
- Section 1.3.4.2, 2016 Agreement regarding Funding Commitments toward Peninsula Corridor Electrification Project between the Authority and Peninsula Corridor Joint Powers Board, and Section 1.3.4.3, 2018 Project Management and Funding Agreement between the Authority and Peninsula Corridor Joint Powers Board, were added as background information.
- Section 1.4.3, Caltrain Grade Separations in Santa Clara County, of the Draft EIR/EIS was deleted in this Final EIR/EIS because the projects are unfunded.
- In Section 1.4, Relationship to Other Transportation Projects in the Study Area, text was updated to indicate the ongoing progress of the projects (i.e., Sections 1.4.3, 1.4.4, 1.4.6, and 1.4.10).

1.1 Introduction

1.1.1 The High-Speed Rail System

The California Legislature passed the High-Speed Rail Act in 1996, forming the Authority as a state governing body responsible for planning, designing, constructing, and operating the California High-Speed Rail (HSR) System. In establishing the Authority, the Legislature found that the state's transportation facilities were insufficient to meet the needs of the state's existing population, that the state's population and the travel demands of its citizens would continue to grow, and that the development of an HSR system is a necessary and viable alternative to automobile and air travel in the state. The Authority's mandate under the High-Speed Rail Act is to develop an HSR system that coordinates with the state's existing transportation network, which includes intercity rail and bus lines, regional commuter rail lines, urban rail and bus transit lines, highways, and airports.

The Authority proposes to construct, operate, and maintain an electric-powered HSR system in California, connecting the San Francisco Bay Area and Central Valley to Southern California. When completed, the nearly 800-mile train system would provide new passenger rail service to more than 90 percent of the state's population. An estimated 176 weekday trains would serve the statewide intercity travel market.[1] The system would use state-of-the-art, electrically powered, steel-wheel-on-steel-rail technology, including contemporary safety, signaling, and automatic train control systems, with trains capable of operating speeds of up to 220 miles per hour in HSR sections that are fully grade-separated and on a dedicated track alignment.

The California HSR System, as illustrated on Figure 1-1, would be implemented in two phases. Phase 1 would connect San Francisco to Los Angeles and Anaheim via the Pacheco Pass and the Central Valley Phase 2 would extend the HSR system from the Central Valley (starting at the Merced Station) to the state's capital in Sacramento and from Los Angeles to San Diego.

[1] *Intercity rail passenger transportation* is defined at 49 United States Code (U.S.C.) 24102(4) as ''rail passenger transportation except commuter rail passenger transportation." *Commuter rail passenger transportation* is defined at 49 U.S.C. Section 24102(3) as "short-haul rail passenger transportation in metropolitan and suburban areas usually having reduced fare, multiple-ride, and commuter tickets and morning and evening peak period operations." The number of trains on different parts of the HSR system will vary depending in schedules and ridership.

Note: HSR System described in the Program EIR/EIS MAY 2019

Figure 1-1 Statewide High-Speed Rail System—Implementation Phases

1.1.2 The Decision to Develop a Statewide High-Speed Rail System

The Authority and the Federal Railroad Administration (FRA) used a tiered environmental review process to support tiered decisions for the HSR system. Tiering of environmental documents means addressing a broad program in "Tier 1" environmental documents, then analyzing the details of individual projects under the larger program in subsequent project-specific or "Tier 2" environmental documents.

The Final Program EIR/EIS for the Proposed California High-Speed Train System (2005 Statewide Program EIR/EIS) (Authority and FRA 2005) provided a programmatic analysis of implementing the HSR system across the state and compared it to the impacts of a no project alternative and a "modal alternative" that involved expanding airports, freeways, and conventional rail to meet the state's future transportation needs. The HSR alternative included consideration of different train technologies and vehicles types, as well as potential corridors and station locations. At the conclusion of the 2005 Statewide Program EIR/EIS, the Authority and FRA made the following decisions:

2005 Tier 1 Decisions	
Selection of transportation option	Selected the HSR alternative over the modal alternative (expanded airports and freeways) and the no project alternative (do nothing) to serve California's growing transportation needs.
Selection of train technology	Selected very high speed, electrified steel-wheel-on-steel-rail technology over magnetic levitation; lower speed, electrified steel wheel on steel rail; and lower speed diesel (non-electrified) steel-wheel-on-steel-rail technology.
Selection of preferred alignment corridors	Selected preferred corridors for most of the statewide system to be studiedin more detail in Tier 2 EIR/EISs. Deferred selection of preferred corridors for Bay Area to Central Valley to a second Tier 1 EIR/EIS process.
Selection of preferred station locations	Selected station locations along the preferred corridors to be studied in more detail in Tier 2 EIR/EISs.
Adoption of mitigation strategies	Adopted broad mitigation strategies to be refined and applied at Tier 2, as part of project planning and development and environmental review.

Sources: Authority 2005; FRA 2005
HSR = high-speed rail
EIR = environmental impact report
EIS = environmental impact statement

After completing the 2005 Statewide Program EIR/EIS, the Authority and FRA prepared a second program EIR/EIS to identify corridor and station locations for the HSR connection between the Bay Area and the Central Valley, examining connections through the Pacheco Pass, the Altamont Pass, or both (i.e., the *Final San Francisco Bay Area to Central Valley High-Speed Train Final Program Environmental Impact Report/Environmental Impact Statement* [2008 Bay Area to Central Valley Final Program EIR/EIS] [Authority and FRA 2008]). In 2008, the Authority and FRA selected a Pacheco Pass connection, with corridors and station locations to be further examined in Tier 2 environmental reviews. As a result of litigation, the Authority prepared additional programmatic environmental review for the Bay Area and the Central Valley section, and again selected the Pacheco Pass connection (in the *Bay Area to Central Valley Partially Revised Final Program Environmental Impact Report* [Authority 2012a]).

2008/2012 Tier 1 Decisions	
Selection of preferred alignment corridors	Selected preferred corridors for connecting the Bay Area to the Central Valley north of Fresno to be studied in more detail in Tier 2 EIR/EIS.
Selection of preferred station locations	Selected stations locations along the preferred corridors to be studied in more detail in Tier 2 EIR/EISs.
Adoption of mitigation strategies	Adopted broad mitigation strategies to be refined and applied at Tier 2, as part of project planning and development and environmental review.

Source: FRA 2008; Authority 2012b, 2012c, 2012d
EIR = environmental impact report
EIS = environmental impact statement

These Tier 1 decisions established the broad framework for the HSR system that serves as the foundation for the Tier 2 environmental review of individual projects. Between San Jose and Merced, the corridor advanced for Tier 2 study was the Pacheco Pass via Henry Miller Road (Union Pacific Railroad [UPRR] Connection) from San Jose to the Central Valley. The station locations advanced for Tier 2 study were a downtown San Jose/Diridon Station and a downtown Gilroy/Caltrain station, with no station between Gilroy and Merced.

The Authority and FRA prepared these Tier 1 documents in coordination with the U.S. Environmental Protection Agency (USEPA) and the U.S. Army Corps of Engineers (USACE). The USEPA and the USACE concurred that the corridors selected by the Authority and FRA in Tier 1 were most likely to yield the least environmentally damaging practicable alternative under Section 404 of the Clean Water Act.

Electronic copies of the Tier 1 documents are available on request by calling the Authority office at 800-455-8166. The Tier 1 documents may also be reviewed at the Authority's offices during business hours at: 770 L Street, Suite 620, Sacramento, CA 95814 and 100 Paseo de San Antonio, Suite 300, San Jose, CA 95113.

1.1.3 Implementation of the Statewide High-Speed Rail System

Since completion of the Tier 1 documents, the State of California has taken a series of steps to advance the implementation of a statewide HSR system. These efforts have resulted in securing dedicated funding for construction of the initial part of the system in the Central Valley and have further defined the State's vision for completing the system. The HSR system has also become a key component of the State's strategy for reducing greenhouse gas (GHG) emissions as discussed in the next subsection.

1.1.3.1 California State Legislation and Funding

In August 2008, the California Legislature adopted Assembly Bill (AB) 3034, finding "it imperative that the state proceed quickly to construct a ... high-speed passenger train system to serve the major metropolitan areas," and submitting The Safe, Reliable, High-Speed Passenger Train Bond Act for the 21st Century (Prop 1A) to the voters. In November 2008, California voters approved Prop 1A, making $9.95 billion in bond funds available to the Authority for initiating construction of the HSR system from San Francisco to the Los Angeles basin and linking the state's major population centers. Prop 1A includes provisions for continuing legislative oversight and requires the Authority to follow certain procedures to access bond funds. In 2012, the Legislature passed Senate Bill (SB) 1029, which appropriated $7.9 billion in federal funds (see Section 1.1.3.4, The Federal Railroad Administration Grant Agreement) and Prop 1A bond funds to begin construction of the HSR system.

The HSR system is identified as an integral GHG reduction measure in the Climate Change Scoping Plan prepared by the California Air Resources Board (CARB) pursuant to AB 32, the California Global Warming Solutions Act of 2006, which required a reduction in GHG emissions to 1990 levels by 2020 (CARB 2008, 2017). In 2014, the Legislature passed SB 862, which

continuously appropriated 25 percent of specified cap-and-trade[2] auction proceeds to Phase 1 (San Francisco to Anaheim) of the HSR system. The Legislature found that the HSR system, once completed and operational, "will contribute significantly toward the goal of reducing emissions of greenhouse gases and other air pollutants" and provides "the foundation for a large-scale transformation of California's transportation infrastructure" by reducing millions of vehicle miles traveled by automobile and reducing the demand for air travel. In 2017, the Legislature extended the cap-and-trade program from 2020 to 2031.

1.1.3.2 Business Plans for the Statewide High-Speed Rail System

The High-Speed Rail Act requires the Authority to prepare, adopt, and submit a business plan to the State Legislature every 2 years describing its implementation approach for the statewide HSR system. Since 2008, the Authority has adopted business plans in accordance with this requirement. Most recently, the Authority adopted its 2018 Business Plan on May 15, 2018, and submitted it to the Legislature on June 1, 2018 (Authority 2018a, 2018b).

The 2018 Business Plan identifies major anticipated milestones for upcoming years, focusing on construction and program delivery. The key objectives and principles from prior business plans remain the same:

- Initiate HSR passenger service as soon as possible.
- Make strategic, concurrent investments throughout the system that will be linked together over time.
- Position the Authority to construct additional increments of the HSR system as funding becomes available.

Like the previous business plans, the 2018 Business Plan describes the phased implementation of the California HSR System. As shown on Figure 1-1, Phase 1 would connect the state's major metropolitan areas, extending from San Francisco and Merced to Los Angeles and Anaheim (the San Francisco Bay Area and Los Angeles Basin regions are considered the "bookends" of the HSR system). Phase 2 would complete extensions to Sacramento and San Diego. Phased implementation of the HSR system is consistent with the provisions of Prop 1A. The 2018 Business Plan also continues to incorporate the concept of "blended" service[3] in certain shared corridors in Northern and Southern California, including between San Francisco and Gilroy, and between Burbank and Anaheim.

With regard to the timing of Phase 1 implementation, the 2018 Business Plan continues the overall approach presented in 2016, which prioritizes connecting the Silicon Valley to the Central Valley. To achieve that objective, the 2018 Business Plan calls for completing two lines initially—one in the Central Valley from an interim station in Madera to Bakersfield, and one in the Bay Area/Silicon Valley, from San Francisco and San Jose to Gilroy—and then completing the connection from the Silicon Valley to the Central Valley via the Pacheco Pass tunnels. Completion of this "valley-to-valley" connection would provide continuous HSR service from San Francisco to Bakersfield. After that portion of the system is built, it is anticipated that the system would be extended to complete all of Phase 1 and, ultimately, Phase 2.

The 2018 Business Plan supports concurrent investments to deliver early benefits to Southern California in the Burbank–Los Angeles–Anaheim corridor and to Northern California in the San Francisco–Gilroy corridor, as well as completion of the environmental review for all Phase 1 project sections statewide from Merced/San Francisco to Los Angeles/Anaheim by 2022.

The Authority released the *Draft 2020 Business Plan: Delivering the Vision* in February 2020 (Authority 2020b). Subsequently, due to the ongoing COVID-19 pandemic uncertainty, the Draft 2020 Business Plan final adoption was extended to April 15, 2021. A Revised Draft 2020

[2] *Cap and trade* refers to the market-based mechanism established by the CARB for achieving the GHG reduction requirements in AB 32.

[3] A "blended" system involves integrating the HSR system with existing intercity and commuter and regional rail systems.

Business Plan was issued on February 9, 2021, for public review and comment. The 2020 Business Plan was adopted by the Authority Board of Directors on March 25, 2021, and submitted to the state legislature on April 12, 2021. The 2020 Business Plan forecasts were developed using the same travel forecasting model as the 2016 and 2018 Business Plans, updated for population and employment forecasts. The 2020 Business Plan Phase 1 medium ridership forecast for 2040 is 38.6 million, and the high ridership forecast is 50.0 million (Authority 2021).

1.1.3.3 The California State Rail Plan

The federal Passenger Rail Investment and Improvement Act of 2008 required states to develop state rail plans no less frequently than every 5 years as a condition of eligibility for federal funding for HSR and intercity passenger rail programs. In accordance with the act, the State of California adopted the *California State Rail Plan* (CSRP) in 2013 (California Department of Transportation [Caltrans] 2013a). The 2013 CSRP stated that it "establishes a statewide vision and objectives, sets priorities, and develops implementation strategies to enhance passenger and freight rail service in the public interest" (Caltrans 2013a). The Plan called for implementation of a statewide HSR system that is integrated into the existing intercity and commuter passenger rail network.

Caltrans released an updated 2018 CSRP in September 2018 that continues to emphasize HSR as a foundational component of the statewide, integrated rail transportation network (Caltrans 2018).

1.1.3.4 The Federal Railroad Administration Grant Agreement

In 2009, FRA announced a competitive grant program to fund HSR projects under the American Recovery and Reinvestment Act of 2009 through its High-Speed Intercity Passenger Rail Program. The State of California, acting through the Authority, successfully competed for these grant funds and received awards totaling approximately $3.5 billion. In 2010, the Authority entered into cooperative agreements with FRA under which the FRA committed to provide the grant funds to support initial construction of the first phase of the HSR system in the Central Valley, as well as related efforts for continued planning, engineering, and right-of-way preservation for the rest of the Phase 1 system between San Francisco and Anaheim.[4]

1.1.3.5 Project-Level Environmental Reviews

In accordance with the tiered approach to environmental review described above in Section 1.1.2, the Authority is preparing Tier 2 (project-level) EIR/EISs for individual sections of the statewide HSR system. Each Tier 2 EIR/EIS evaluates a project section of the HSR system that serves a useful transportation purpose on its own and could function independently even if the adjacent sections were not completed. Each Tier 2 EIR/EIS evaluates proposed alignments and stations in site-specific detail to provide a complete assessment of the direct, indirect, and cumulative effects of the proposed project; considers public and agency participation in the screening process; and is developed in consultation with resource and regulatory agencies, including USEPA and USACE. Each Tier 2 EIR/EIS is intended to be sufficient to support USACE's permit decisions, where applicable. Figure 1-2 illustrates the Tier 2 project sections. On July 23, 2019, the State of California and FRA signed a Memorandum of Understanding (MOU) that delegated FRA's responsibilities to the State to implement the National Environmental Policy Act (NEPA) and other federal statutes, regulations, and executive orders and to issue a record of decision for each of the Tier 2 reviews underway at that time.

[4] The grant agreements are available by request via the Authority's website: www.hsr.ca.gov/About/Funding_Finance/funding_agreements.html.

Note: HSR System described in the Program EIR/EIS

APRIL 2016

Figure 1-2 Statewide High-Speed Rail System, Phase 1 and Phase 2—Project Sections

To date, Tier 2 EIR/EISs have been completed for the following sections:

- Merced to Fresno
- Fresno to Bakersfield
- Bakersfield to Palmdale
- Burbank to Los Angeles

Tier 2 EIR/EISs for the other Phase 1 project sections, listed below, are all in progress:

- San Francisco to San Jose
- Palmdale to Burbank
- Los Angeles to Anaheim

In addition, the Authority has completed supplemental EIR/EISs for:

- Merced to Fresno: Central Valley Wye
- Fresno to Bakersfield: Locally Generated Alternative (Bakersfield Station)

In October 2018, the Authority certified a Final Supplemental EIR and approved the Fresno to Bakersfield: Locally Generated Alternative. The Authority's Chief Executive Officer signed the Record of Decision in October 2019 and a Record of Decision Combined with a Final Supplemental EIS for the Locally Generated Alternative was released on November 8, 2019.

The Authority published the Merced to Fresno Section: Central Valley Wye Draft Supplemental EIR/EIS in May 2019 (Authority 2019). The Authority conducted the public review of the Central Valley Wye Draft Supplemental EIR/EIS under the California Environmental Quality Act (CEQA) in May and June 2019 and released the same document for NEPA public review in September 2019 to support a federal decision on the Central Valley Wye. The comment period ended October 28, 2019. On September 10, 2020, the Authority certified a Final Supplemental EIR and approved the *Merced to Fresno Section: Central Valley Wye Supplemental EIR/EIS* (Authority 2020a). The Authority's Chief Executive Officer signed the Supplemental Record of Decision on September 16, 2020. This Supplemental Record of Decision identifies the SR 152 (North) to Road 11 Wye Alternative as the Selected Alternative for the Project. Figures throughout this San Jose to Merced Final EIR/EIS show the Wye alignments as they were in analyzed in the *Merced to Fresno Section: Central Valley Wye Supplemental EIR/EIS*.

1.1.4 The San Jose to Merced Project Section

Consistent with the Tier 1 decisions, the San Jose to Merced Project Section would provide HSR service from the San Jose Diridon Station to a station in downtown Merced. This Project Section would allow trains to and from the Bay Area to transition smoothly from north/south to east/west travel with a minimum reduction in speed and follow existing transportation corridors as much as feasible. HSR stations at San Jose Diridon, Gilroy, and Merced would support transit-oriented development, provide an interface with regional and local mass transit services, and provide connectivity to the South Bay[5] and Central Valley[6] highway network.

The Project Section has been evaluated in three extents as illustrated on Figure 1-3: from San Jose to the western limit of the Central Valley Wye; the Central Valley Wye itself; and from the northern limit of the Central Valley Wye to Merced (i.e., the northern portion of the Merced to Fresno Project Section).

The following terms are defined as follows for purposes of this report:

- **Project Section:** This signifies the San Jose to Merced project with the station termini.
- **Project Extent:** The term "*Project extent*" is used to refer to the three portions of the Project Section: (1) San Jose to Central Valley Wye (Scott Boulevard to Carlucci Road); (2) Central Valley Wye (Carlucci Road to Ranch Road in the north and Avenue 19 in the south); and (3) Merced North (Ranch Road in the south to the Merced Station). Collectively these three "project extents" form the Project Section connecting San Jose and Merced.

Source: Authority and FRA 2016 APRIL 2016

Figure 1-3 San Jose to Merced Project Section

The Central Valley Wye connects the Merced to Fresno and Bay Area to Central Valley HSR corridors. The Central Valley Wye is a track configuration that allows north/south trains to transition to east/west travel to reach the Bay Area and vice versa. Portions of the track are elevated to allow trains to travel up and over other track. The Central Valley Wye is an extent of both the Merced to Fresno and San Jose to Merced Project Sections. These sections overlap from Carlucci Road in Merced County, along the east/west portion of the Central Valley Wye and

[5] *South Bay* refers to Santa Clara County.

[6] The Sacramento and San Joaquin Valleys combined are called the Central Valley.

the northern extent of the alignment along State Route (SR) 99 to Merced. The Merced to Fresno Section Final EIR/EIS (Authority and FRA 2012) has been completed. The Authority and FRA selected the north/south track alignments and station sites, including the northern part of the alignment along SR 99/UPRR that travels into the Downtown Merced Station, but they deferred a decision on the wye connection. The Authority published a draft supplemental EIR for the Merced to Fresno Section in May 2019 (*Merced to Fresno Section: Central Valley Wye Draft Supplemental EIR* [Authority 2019]). As noted above, the Authority conducted the public review of the Central Valley Wye Draft Supplemental EIR/EIS under the California Environmental Quality Act (CEQA) in May and June 2019 and released the same document for NEPA public review in September 2019 to support a federal decision on the Central Valley Wye. The comment period ended October 28, 2019. On September 10, 2020, the Authority certified a Final Supplemental EIR and approved the Central Valley Wye. The Authority's Chief Executive Officer signed the Supplemental Record of Decision on September 16, 2020.

1.1.4.1 The San Jose to Central Valley Wye Project Extent

This *San Jose to Merced Project Section Environmental Impact Report/Environmental Impact Statement* (Final EIR/EIS) documents project-level analyses of new HSR features that enable HSR operations and service to the San Jose Diridon, Gilroy, and Merced Stations.

For the purposes of this Final EIR/EIS, the detailed evaluation is focused on the San Jose to Central Valley Wye Project Extent (project or project extent), which extends from Scott Boulevard in Santa Clara, north of the San Jose Diridon Station, to the western limit of the Central Valley Wye at Carlucci Road in Merced County. This analysis overlaps with the southern portion of the San Francisco to San Jose Project Section starting in Santa Clara at Scott Boulevard, just north of Diridon Station, and ending at West Alma Avenue in San Jose.

The project extent between Scott Boulevard and Carlucci Road is about 90 miles of the approximately 145-mile-long Project Section (Figure 1-3). Depending on the project alternative selected for implementation, train operations would transition to blended service north of the San Jose Diridon Station (either at Scott Boulevard or Interstate [I-] 880 in Santa Clara) or at Gilroy. Also depending on the selected alternative, the project would be a fully dedicated HSR system to the Central Valley Wye either south of the San Jose Diridon Station or eastward from an HSR station in downtown Gilroy.

Southward from the vicinity of the Caltrain Tamien Station (approximately 2.5 miles south of San Jose Diridon), the dedicated HSR alignments would follow the UPRR/Monterey Road transportation corridor or along the west side of U.S. Highway (US) 101 to avoid downtown Morgan Hill (approximately 23 miles south of San Jose Diridon), to a dedicated HSR station in downtown Gilroy or east of Gilroy. The HSR alignment would extend from the existing railroad right-of-way owned by Caltrain at the Tamien Station to Gilroy via the existing railroad right-of-way owned by UPRR. Caltrain and UPRR provide diesel-powered passenger and freight services along the Monterey Road corridor to Gilroy. HSR would electrify this segment to enable blended operation with Caltrain electric-powered passenger rail equipment. Between the Gilroy Station and I-5, a new, dedicated HSR corridor near SR 152 would traverse Pacheco Pass of the Diablo Range north of the San Luis Reservoir, then into the Central Valley east of I-5. The Authority would construct tunnels through two portions of Pacheco Pass. East of Pacheco Pass, the new HSR alignment would pass north of Volta and Los Banos and east toward Henry Miller Road in Merced County. The alignment would extend along the south side of Henry Miller Road to its connection with the Central Valley Wye at Carlucci Road in Merced County. More detail on the San Jose to Merced Project Section is provided in Chapter 2, Alternatives, of the Final EIR/EIS.

1.1.5 Lead Agencies, Cooperating Agencies, and Responsible Agencies

Pursuant to 23 United States Code (U.S.C.) Section 327, under the NEPA Assignment MOU between FRA and the State of California, effective July 23, 2019, the Authority is the federal lead agency for environmental reviews and approvals for all Authority Phase 1 and Phase 2 California HSR System projects (FRA and State of California 2019). In this role, the Authority is the project sponsor and the lead federal agency for complying with NEPA and other federal laws. The FRA

administers the High-Speed Intercity Passenger Rail Program and has awarded California $3.48 billion in grant funding for statewide HSR system environmental studies, as well as in the Central Valley. The FRA has primary responsibility for developing and enforcing railroad safety regulations in accordance with Title 49 U.S.C. Subtitle V, Part A (49 U.S.C. § 20101 et seq.) and for performing Clean Air Act Conformity determinations and other federal approvals retained by the FRA.

Three cooperating agencies participate in the NEPA review process. The USACE agreed by letter, dated April 13, 2010, to participate as a cooperating agency under NEPA based on its role in the permitting and approvals process. The U.S. Department of the Interior, Bureau of Reclamation acknowledged cooperating agency status in a memorandum of agreement with the Authority on April 30, 2013. The Surface Transportation Board (STB), by letter dated May 2, 2013, is also a cooperating agency under NEPA based on its role in approving rail line construction.[7]

Multiple other federal agencies have been involved with and contributed to the environmental review, including the USEPA, U.S. Fish and Wildlife Service, National Marine Fisheries Service, National Park Service, Federal Emergency Management Agency, U.S. Department of Veterans Affairs, and the Advisory Council on Historic Preservation.

A number of state and regional California agencies serve as CEQA responsible agencies for the project. These are the California Department of Fish and Wildlife, Caltrans, California Department of Water Resources, California Office of Historic Preservation, California Public Utilities Commission, California State Lands Commission, PCJPB (Caltrain), Pajaro River Watershed Flood Prevention Authority, Regional Water Quality Control Boards, State Water Resources Control Board, Santa Clara Valley Water District, Central Valley Flood Protection Board, Bay Area Air Quality Management District, Monterey Bay Unified Air Pollution Control District, and San Joaquin Valley Unified Air Pollution Control District. The Final EIR/EIS for the San Jose to Merced Project Section can be used by these agencies either through the provisions of CEQA Guidelines Section 15220 et seq. or CEQA Guidelines Section 15096 to approve or permit aspects of the HSR project.

1.1.6 Compatibility with Federal Transportation Policy

In 2008, the U.S. Congress enacted a major reauthorization of intercity rail passenger legislation, creating a new priority for rail passenger services in the nation's transportation system. The Passenger Rail Investment and Improvement Act of 2008 (Division B of Public Law 110-432) authorized the appropriation of federal funds to support implementing high-speed and intercity rail passenger service, including authority for the Secretary of Transportation to establish and implement an HSR corridor development program. In the American Recovery and Reinvestment Act of 2009 (Public Law 111-5), Congress appropriated $8 billion in capital assistance for HSR corridors and intercity rail passenger service. Congress provided an additional $2.5 billion in the Department of Transportation Appropriations Act (Title I, Division A of the Consolidated Appropriations Act, 2010). Public Law 112-110 reduced available funding by $400 million. In addition, FRA also issued a strategic plan, *Vision for High-Speed Rail in America* (FRA 2009), which described the agency's plan for intercity passenger rail development and subsequent program guidance to implement the High-Speed Intercity Passenger Rail Program with funding provided by Congress through the appropriations acts.

The HSR system is also consistent with recent expressions of federal multimodal transportation policy—most notably the Fixing America's Surface Transportation Act (FAST Act) (Public Law 114-94, December 4, 2015); the Moving Ahead for Progress in the 21st Century Act (Public Law 112-141, July 6, 2012); the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users; the Transportation Equity Act for the 21st Century (Public Law 109-59,

[7] The STB is an independent federal agency with jurisdiction over the construction and operations of new interstate rail lines (49 U.S.C. §§ 10502, 10901). In 2013, the STB determined it has jurisdiction over all sections of the proposed California statewide HSR system, including the San Jose to Merced Project Section, because of the HSR system's connection to the existing interstate rail network. STB, Docket No. FD 35724 (April 18, 2013).

August 10, 2005); and the Intermodal Surface Transportation Efficiency Act of 1991 (Public Law 102-240, December 18, 1991). These laws encourage public transportation investment that increases national productivity and domestic and international competition, while improving safety and social and environmental conditions. These laws encourage investments that offer benefits such as the following:

- Link all major forms of transportation.
- Improve public transportation systems and services.
- Provide better access to seaports and airports.
- Enhance efficient operation of transportation facilities and service.

As the most current expression of federal multimodal transportation policy, the FAST Act seeks to improve surface transportation infrastructure, including roads, bridges, transit systems, and the passenger rail network. It provides long-term funding certainty for surface transportation, meaning that states and local governments can move forward with critical transportation projects, such as new highways and transit lines, with the confidence that they will have a federal partner over the long term. Overall, the FAST Act maintains current program structures and shares funding between highways and transit. The law also makes changes and reforms to many federal transportation programs, including streamlining the approval processes for new transportation projects and financing, providing new safety tools, and establishing new programs to advance critical freight projects.

1.2 Purpose of and Need for the High-Speed Rail System and the San Jose to Merced Project Section

1.2.1 Purpose of the High-Speed Rail System

The 2005 Statewide Program EIR/EIS established the purpose of the statewide HSR system and identified and evaluated alternative HSR corridor alignments and stations as part of a statewide HSR system (Authority and FRA 2005).

> *The purpose of the statewide HSR system is to provide a reliable high-speed electrified train service that links the major metropolitan areas of the state and delivers predictable and consistent travel times. A further objective is to provide an interface with commercial airports, mass transit, and the highway network and to relieve capacity constraints of the existing transportation system as increases in intercity travel demand in California occur in a manner sensitive to and protective of California's unique natural resources.*

1.2.2 Purpose of the San Jose to Merced Project Section

The purpose of this project is to implement the San Jose to Merced section of the California HSR system: to provide the public with electric-powered high-speed rail service that provides predictable and consistent travel times between major urban centers and connectivity to airports, mass transit systems, and the highway network in the south San Francisco Bay Area and Central Valley; and to connect the Northern and Southern portions of the statewide HSR system.

The purpose and need for the San Jose to Merced Project Section was developed through a process established by the Authority, FRA, USACE, and USEPA pursuant to a November 2010 memorandum of understanding that was intended to facilitate the integration of NEPA, Section 404 of the Clean Water Act, and Section 14 of the Rivers and Harbor Act (MOU). The parties reached agreement on the purpose and need in August 2011.

For Clean Water Act Section 404(b)(1) compliance, the USACE must take into consideration the applicant's needs in the context of the geographic area of the proposed action and the type of project being proposed. The USACE has determined that the overall project purpose (as stated above) allows for a reasonable range of alternatives to be analyzed, as is acceptable as the basis for the USACE 404(b)(1) alternatives analysis.

1.2.3 CEQA Project Objectives of the High-Speed Rail System in California and in the San Jose to Merced Project Section Area

The Authority's statutory mandate is to plan, build, and operate an HSR system coordinated with California's existing transportation network, particularly intercity rail and bus lines, commuter rail lines, urban rail lines, highways, and airports. As the lead agency, the Authority is preparing this Final EIR/EIS consistent with specific CEQA EIR content and processing requirements. CEQA Guidelines Section 15124 requires an EIR to include a statement of objectives that will support the underlying purpose of the project. In response to its statutory mandate and CEQA requirements, the Authority has adopted the following objectives and policies for the proposed HSR system and the Project Section:

- Provide intercity travel capacity to supplement critically overused interstate highways and commercial airports.
- Meet future intercity travel demand that will be unmet by current transportation systems and increase capacity for intercity mobility.
- Maximize intermodal transportation opportunities by locating stations to connect with local transit, airports, and highways.
- Improve the intercity travel experience for Californians by providing comfortable, safe, frequent, and reliable high-speed travel.
- Provide a sustainable reduction in travel time between major urban centers.
- Increase the efficiency of the intercity transportation system.
- Maximize the use of existing transportation corridors and rights-of-way to the extent feasible.
- Develop a practical and economically viable transportation system that can be implemented in phases by 2030, and generate revenues in excess of operations and maintenance costs.
- Provide intercity travel in a manner sensitive to and protective of the region's natural and agricultural resources, and reduce emissions and vehicle miles traveled for intercity trips.

While these CEQA project objectives are not directly incorporated into the Purpose and Need under NEPA, an alternative's ability to achieve these CEQA project objectives will be considered in evaluating the reasonableness of an alternative under NEPA.

1.2.4 Statewide and Regional Need for the High-Speed Rail System in the San Jose to Merced Project Section Area

The approximately 145-mile-long San Jose to Merced Project Section is an essential component of the statewide HSR system. The Project Section would provide access to a new transportation mode, contribute to increased mobility throughout California, and connect the Bay Area to the rest of the statewide HSR system via four counties: Santa Clara, San Benito, Merced, and Madera, as illustrated on Figure 1-3. As major population and economic centers for California, the South Bay and Central Valley regions contribute significantly to the statewide need for a new intercity transportation service that would connect San Francisco with the Central Valley and Los Angeles.

The capacity of California's intercity transportation system, including the southern Bay Area and Central Valley systems, is insufficient to meet existing and future travel demand. The current and projected future system congestion will continue to result in deteriorating air quality, reduced reliability, increased travel times, more highway accidents, and increasing GHG emissions. The system has not kept pace with the tremendous increase in population, economic activity, and tourism in the state, including in the Bay Area and Central Valley.

The interstate highway system, commercial airports, and the conventional passenger rail system serving the intercity travel market are operating at or near capacity and will require large public investments in maintenance and expansion to meet existing demand and future growth over the next 25 years and beyond. Moreover, the feasibility of expanding many major highways and key

airports is uncertain; some needed expansions may be impractical or may be constrained by physical, regulatory, environmental, political, and other factors.

The need for improvements to intercity travel in California, including intercity travel between the Bay Area and the Central Valley, relates to the following issues:

- Future growth in demand for intercity travel, including the growth in demand in the Bay Area and Central Valley regions
- Capacity constraints that will result in increasing congestion and travel delays, including those in the South Bay and Central Valley regions
- Unreliability of travel stemming from congestion and delays, weather conditions, accidents, and other factors that affect the quality of life and economic well-being of residents, businesses, and tourists in California, including in the South Bay and Central Valley regions
- Reduced mobility as a result of increasing demand on limited modal connections among major airports, transit systems, and passenger rail in the state, including in the South Bay and Central Valley regions
- Poor and deteriorating air quality and pressure on natural resources and agricultural lands due to expansion of highways and airports, as well as continued urban development, including in the Bay Area and Central Valley
- Legislative mandates to moderate the effects of transportation on climate change, including required reductions in GHG emissions caused by vehicles powered by the combustion of carbon-based fuels

As major population and economic centers, the southern San Francisco Bay Area and Central Valley regions contribute significantly to the statewide need for a new intercity transportation service that would connect these regions to each other and to other major population and economic centers of the state. The following sections provide additional information about the factors contributing to the need for the Project Section.

1.2.4.1 Travel Demand and Capacity Constraints

Long-distance intercity trips, defined as those trips greater than 50 miles, are a large and growing proportion of the total travel market in California as a result of population and employment growth. To accommodate this increased demand, the state's long-distance passenger transportation infrastructure—highways, railroads, and air service—will require capacity expansion.

Population and Employment

Between 2010 and 2040, the California Department of Finance (CDOF) projects that California's population will increase by almost 10 million residents, from approximately 37 million to 47 million people (approximately 26 percent growth), as shown in Table 1-1. Total population is expected to grow steadily to approximately 50 million people by 2050 (CDOF 2014). Santa Clara County growth rates are similar to statewide projected growth, while the population growth rate in the much smaller San Benito, Merced, and Madera Counties will be about double that of state population growth. The CDOF projects the four-county population to increase by 35 percent, from 2.2 million to 2.9 million residents, between 2010 and 2040.

Table 1-1 Population Growth in California and the Counties of the San Jose to Merced Project Section

Area	Population		
	2010	2040 (projected)	Percent Growth 2010 to 2040
Santa Clara County	1,785,089	2,331,887	31%
San Benito County	55,547	82,969	49%
Merced County	256,800	389,934	52%
Madera County	151,466	238,514	57%
Counties of the San Jose to Merced Project Section combined[1]	2,248,902	2,954,900	35%
California	37,341,978	47,233,240	26%

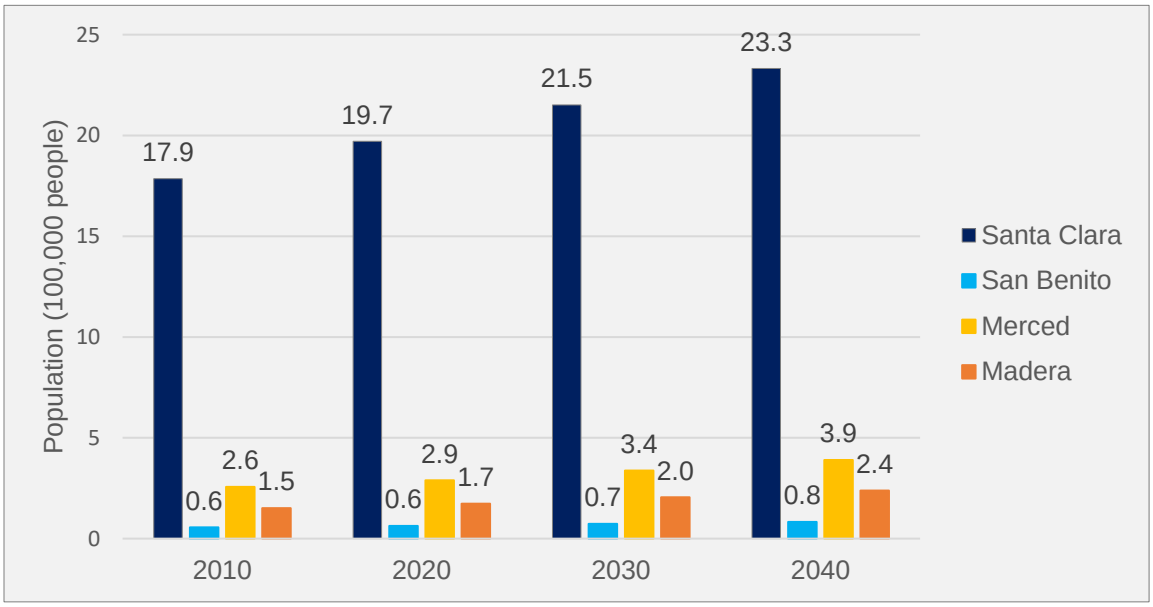
Source: CDOF 2014

[1] The San Jose to Central Valley Wye Project Extent crosses three counties: Santa Clara, San Benito, and Merced; the full Project Section extends into Madera County.

Between 2010 and 2040, the Association of Bay Area Governments (ABAG) and Metropolitan Transportation Commission (MTC) project that the Bay Area will experience a growth of 1.3 million jobs, over 2 million people, and approximately 820,000 households (ABAG and MTC 2017).

The population will become older and more diverse, influencing types of households and their location choices. While the 2040 population as a whole is projected to be 22 percent larger than the 2010 population, growth will differ widely by age group. The number of school-aged children (5–17 years old) is projected to decline, while people 65 and over will account for more than half of all growth in the region. ABAG and MTC's estimate of net commuting between Bay Area counties and other areas shows that net in-commuting will be expected to grow by up to 53,000 workers between 2010 and 2040 (ABAG and MTC 2017). Between 2010 and 2040, the Central Valley population is projected to grow by 43 percent, from 7.1 million to 10.2 million (CDOF 2014). This growth away from urban centers is likely the result of people seeking affordable housing within commuting range of major metropolitan areas. Realization of this growth will place increased demands on the Central Valley local roads, highways, airports, and transit systems.

Figure 1-4 illustrates the projected population growth (in units of 100,000 people) between 2010 and 2040 by 10-year increments in Santa Clara, San Benito, Merced, and Madera Counties.



Source: CDOF 2014

DECEMBER 2016

Figure 1-4 Population Growth for Santa Clara, San Benito, Merced, and Madera Counties

Of all the counties in the Bay Area, Santa Clara County is projected to experience the greatest household and employment growth (31 and 30 percent of the total projected growth, respectively). Substantial job growth is expected in Bayside communities and the city of San Jose (ABAG and MTC 2017). This increase in people living and working in southern Santa Clara County will put additional pressure on the already congested existing transportation network in the region.

In Merced County, Caltrans projects employment to increase by approximately 38 percent from approximately 68,600 jobs in 2010 to nearly 93,700 jobs in 2040 (Caltrans 2015). Employment is projected to grow in the agricultural sector, a primary component of the region's economy; Merced County ranks fifth in agricultural production in California. Outside the agricultural sector, the California Employment Development Department expects employment growth in private educational services/health care/social assistance, manufacturing, retail trade, and leisure and hospitality (California Employment Development Department 2016).

As shown in Table 1-2, the unemployment rate in San Benito, Merced, and Madera Counties is currently higher than the statewide rate, and the counties' per capita personal income is much lower than the state's as a whole. The California Employment Development Department expects employment growth in some industry sectors. The amount of employment growth projected is less than the amount of projected population growth. San Benito, Merced, and Madera Counties, therefore, will be challenged to reduce their unemployment and increase the per capita incomes of their residents. Because of Santa Clara County's already low unemployment rates, the increased employment opportunities in the immediate area could exceed worker availability to fill positions. Projected increases in Merced County employment opportunities may also provide more opportunities for currently unemployed residents.

Table 1-2 Unemployment and Income in California and Santa Clara, San Benito, Merced, and Madera Counties

Area	Unemployment Rate (2015)	Income Per Capita (2015)
California	6.2	$53,224
Santa Clara County	4.2	$79,302
San Benito County	7.6	$43,630
Merced County	11.4	$33,852
Madera County	10.5	$33,730

Sources: CEDD 2016; Caltrans 2016a

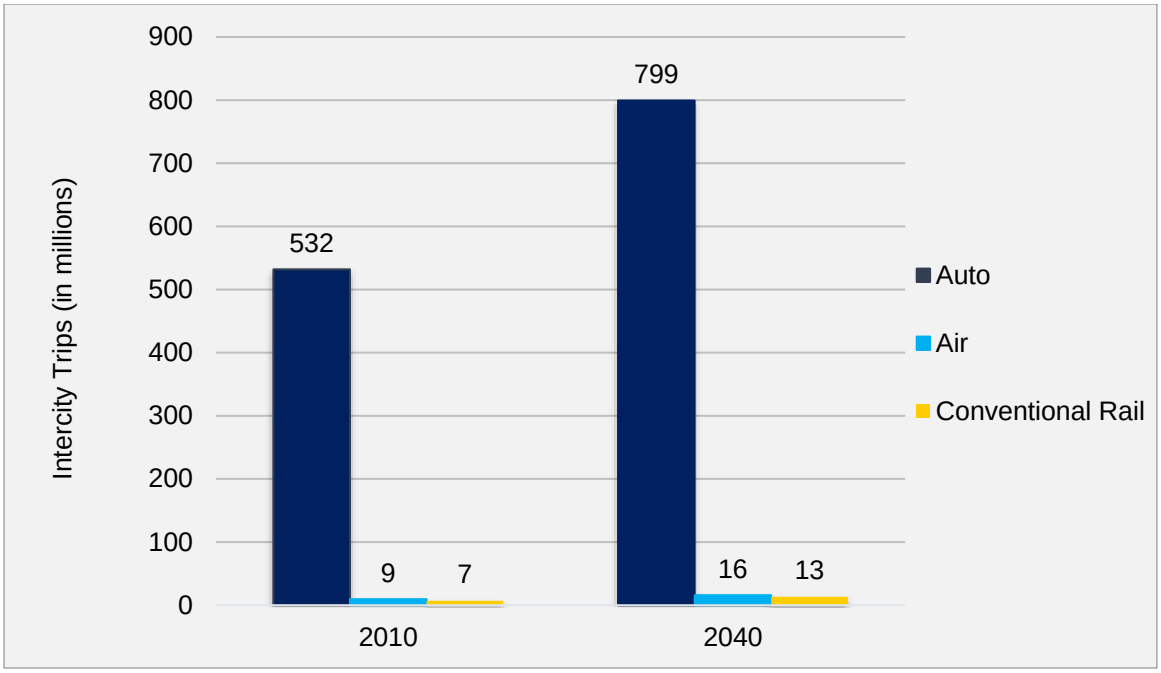
The growth of this region combined with the growth of the Bay Area means that already congested local roads, highways, airports, and transit systems will face unprecedented demand in the years ahead as people migrate to the state. Operation of the HSR system between San Jose and Merced would reduce stress on the existing transportation systems by reallocating some of the regional demand away from highways and airports.

The HSR system would serve planned mixed-use developments at the proposed HSR stations in San Jose and Gilroy. The new housing proposed as part of the HSR station area planning would bring more employees into the area to help meet the projected job growth. Providing HSR service would also support economic growth, providing a new regional transportation service that would allow more direct access to San Francisco and Silicon Valley economic centers. HSR would not offer a below-market, subsidized passenger rail service, but instead would provide rapid long-distance travel, priced at commercial market rates. The pricing structure for HSR fares would be expected to be similar to typical airline fares, but fares would fluctuate based on a variable pricing strategy (Authority 2018a). The cost of the HSR fares would discourage a daily commute to and from the Bay Area and Los Angeles basin.

Travel Demand

The population and employment growth in California has resulted in increased travel demand, which is expected to continue to increase through 2040. Figure 1-5 illustrates the long-distance intercity trips[8] in California in 2010 and 2040 for automobiles, air travel, and conventional rail. Long-distance intercity travel in California is estimated to increase by approximately 51 percent between 2010 and 2040, from 548 million to about 828 million trips. The fastest-growing mode of transit for intercity trips is conventional rail, which is expected to increase 86 percent between 2010 and 2040. However, without HSR the automobile will continue to account for the greatest share of long-distance intercity travel, and by 2040 is expected to account for more than 96 percent of all long-distance intercity travel. Figure 1-6 illustrates the major routes and airports used for long-distance travel among the markets potentially served by the HSR system.

[8] Defined as trips greater than 50 miles.



DECEMBER 2016

Figure 1-5 Long Distance Intercity Trips in California (in millions)

Note: Train lines in the project extent are described in Section 3.2, Transportation

APRIL 2016

Figure 1-6 Major Intercity Travel Routes and Airports

The jobs-to-housing ratio is an indicator of the balance between employment and housing in a geographical area and can serve as a rough indicator of the amount of commuter travel demand to or from that geographical area. A low jobs/housing ratio (less than 1.0) suggests that relatively few job opportunities exist for community residents, requiring commuting elsewhere for work; while a high ratio (greater than 1.5) suggests a surplus of jobs, with employees needing to commute from surrounding areas to fill the available jobs. Table 1-3 shows the 2010 jobs/housing ratio and projected 2040 jobs/housing ratio for the Project Section region. As the data indicate, San Benito and Merced Counties have a low jobs/housing ratio, suggesting that there are not enough jobs within the two counties and workers who reside in these areas may need to commute into adjacent counties for employment. The low jobs/housing in San Benito and Merced Counties is projected to remain approximately the same through 2040 (Caltrans 2015).

Table 1-3 Jobs/Housing Ratio 2010 and 2040

Area	2010			2040 (projected)		
	Jobs	Households	Ratio	Jobs	Households	Ratio
Cities[1]						
San Jose[2]	377,140	301,370	1.3	524,510	432,030	1.2
Morgan Hill[2]	17,520	12,330	1.4	22,080	16,150	1.4
Gilroy[2]	17,600	14,180	1.2	21,900	17,040	1.3
Los Banos[3]	17,130	10,152	1.7	35,200[4]	27,200[4]	1.3
Merced[3]	25,800	27,167	1.0	—	50,700[4]	—
Counties						
Santa Clara	926,260	604,200	1.5	1,229,530	818,390	1.5
San Benito	14,220	16,800	0.8	20,190	22,600	0.9
Merced	68,600	75,600	0.9	93,700	97,600	0.9
Madera	42,855	43,304	1.0	79,877	80,626	1.0

Sources: ABAG and MTC 2017; City of Los Banos 2009; Caltrans 2015; Madera County Transportation Commission 2014
[1] The table selectively presents information to include cities to be served by the San Jose to Merced Project Section.
[2] City in Santa Clara County
[3] City in Merced County
[4] Figures from latest General Plan update, which projected through 2030

The projected 2040 population increases throughout Santa Clara, San Benito, Merced, and Madera Counties and the Central Valley would increase the number of commuters on freeways, commuter rail systems, and regional and local bus systems. The jobs/housing ratio projections provide another indication that economic growth in Santa Clara and Merced Counties will continue to increase demand for intercity travel services. The widening gap between population and employment growth and roadway capacity expansion, particularly in Santa Clara County, means that a growing number of the region's residents will face congested travel conditions that will persist for longer periods of time, as more drivers adjust their time of travel to avoid the most heavily congested peak period commute hours.

Freeway Congestion and Travel Delays

To meet the growing demands of Santa Clara County and adjacent areas, the (Santa Clara) Valley Transportation Authority (VTA) has prioritized transit expansions such as the Bay Area Rapid Transit (BART) extensions to Berryessa and Santa Clara, Caltrain electrification, express lane expansions in the SR 85/US 101 and SR 237 corridors, and major improvements to the SR 152 corridor between SR 156 and US 101. Additionally, the Merced County Association of Governments (MCAG) has prioritized plans to increase the capacity of SR 99 and SR 140 in

the Central Valley. These improvements, however, will not fully meet the ideal operating standards set forth in VTA's *Valley Transportation Plan 2040: The Long-Range Transportation Plan for Santa Clara County* (VTP 2040 [VTA 2014a]) and MCAG's *2018 Regional Transportation Plan/Sustainable Communities Strategy Amendment No. 1* (RTP/SCS) for Merced County (MCAG 2018) because of the projected increase in population, jobs and, consequently, traffic congestion.

US 101, SR 152, and SR 99 are the major roadways that parallel the Project Section (Figure 1-7). Daily freeway congestion is highest in Santa Clara County, primarily on US 101 and routes traveling into San Jose in the morning and out in the afternoon. According to the MTC Vital Signs data (MTC 2015), several of the Bay Area's most congested roadway segments are along roadways entering or exiting San Jose, including the following (ranked in descending order of congestion):

1. I-680 southbound (morning) between King Road and North Wolfe Road (20th)
2. US 101 northbound (morning) between Silver Creek Valley Road and Tully Road (30th)
3. SR 85 northbound (morning) between SR 87 and Winchester Boulevard (33rd)
4. SR 87 northbound (morning) between SR 85 and Almaden Expressway (45th)
5. US 101 southbound (evening) between Coyote Creek Golf Drive and Cochrane Road (88th)

Note: Major roadways in the project extent are described in Section 3.2, Transportation

Source: Authority and FRA 2016

APRIL 2016

Figure 1-7 Major Roadways

Intercity travel within the larger San Joaquin Valley[9] and specifically in Merced and Madera Counties occurs primarily on SR 152 and SR 99. SR 99 is the principal north/south highway connection between the region's major cities, currently carrying annual daily traffic volumes of 38,000 to more than 100,000 vehicles (Caltrans 2013b). Most of SR 99 was built in the late 1950s and early 1960s to accommodate a smaller population and correspondingly smaller transportation infrastructure demands. The increased San Joaquin Valley population and the resulting land use patterns have generated a reliance on automobiles for most trips, placing additional demand on existing highways. Table 1-4 shows the 2015 and 2040 daily vehicle miles traveled (VMT) in all three counties (Santa Clara, San Benito, and Merced) through which the project extends, the full Project Section extends into Madera County. VMT in these counties is expected to increase at an average annual growth rate of between 1.1 and 1.9 percent over the 2015–2040 period. This increase in VMT will further exacerbate the traffic congestion in the region.

What is VMT?

Vehicle miles traveled, or VMT, is a measurement of miles traveled by vehicles within a specific region over a specific period of time.

Table 1-4 Current and Projected Vehicle Miles Traveled

County	Daily Vehicle Miles Traveled (million)		
	Existing Conditions (2015)	Year 2040 Projection	Annual Growth Rate (%)
Santa Clara	28.3	36.2	1.1%
San Benito	1.7	2.3	1.5%
Merced	3.4	5.0	1.9%
Madera	2.0	3.0	1.3%

Source: Authority 2016

Improvements to several major highways are being planned, with completion anticipated in the next 10 to 15 years. SR 237 express lanes and Central, Montague, and San Tomas Expressway improvements are planned in Santa Clara County. The improvements in Santa Clara County primarily entail construction of a highway express lane system—individual interchange upgrades, conversion of high-occupancy vehicle lanes to express lanes, and construction of new express lanes. These improvements would not cumulatively add substantial capacity to the existing highway system but rather would enhance the efficiency of existing highways. The SR 152 Trade Corridor Project proposes infrastructure improvements to enhance safety on SR 152 between US 101 and the Santa Clara/Merced county line to accommodate long-term commercial, commuter, and recreational traffic needs (VTA 2014a). Other proposed improvements in *VTP 2040* (VTA 2014a) and the 2018 Merced County RTP/SCS (MCAG 2018) would increase capacity by widening existing roadways within the project area—for example, Merced County improvements would provide additional capacity in the Los Banos area. Although these plans propose additional travel and auxiliary lanes on freeways or reclassifying existing facilities, the added capacity would not be sufficient to ease traffic flow within the region or offset the projected increase in population and jobs. Transit projects and other more efficient and sustainable modes of travel are heavily encouraged by both VTP 2040 (VTA 2014a) and the 2018 Merced County RTP/SCS (MCAG 2018), which together cover the entire Project Section corridor.

[9] The San Joaquin Valley is a north-south area, the southern half of the Central Valley, approximately 250 miles long and bordered on the west by the coastal mountain ranges. Its eastern boundary joins the southern two-thirds of the Sierra bioregion, which features Yosemite, Kings Canyon, and Sequoia National Parks. Merced County falls within the San Joaquin Valley (Valley Clean Air Now 2015).

Caltrans has begun implementing the *Route 99 Corridor Updated Business Plan* (Caltrans 2013b). The plan proposes removal of remaining at-grade intersections and improvement of others to higher capacity. This work will continue over the next 10 years, depending on available funding. The plan proposes widening the route between Merced and Fresno from four to six lanes to ease traffic flow between interchanges. The lane expansions, however, will not reduce projected congestion along SR 99 through 2040. According to the *Route 99 Corridor Updated Business Plan* (Caltrans 2013b), only a shift in vehicle travel to alternative modes can restore better traffic flows.

The Project Section reflects the statewide growth patterns and trends, where much of the intercity travel in California consists of trips of intermediate distance (i.e., trips at least 150 miles long). Table 1-5 shows the statewide expected growth in traffic volumes on major highways in California over the period 2010–2040.

Table 1-5 Travel Growth for Intercity Highways

Major Highways	Average Daily Volume 2010	Average Daily Volume 2040 Projection	Percent Change 2010 to 2040
US 101 (between San Francisco and San Jose)	211,000	306,000	46
I-280 (between San Jose and San Francisco)	87,000	133,000	53
US 101 (between San Jose and Madera)	78,000	114,000	46
SR-152 (between San Jose and Madera)	27,000	48,000	78
SR-99 (between Modesto and Sacramento)	57,000	81,000	42
SR-99 (between Bakersfield and Modesto)	110,000	174,000	58
SR-99 (between Bakersfield and Merced)	24,000	43,000	79
I-5 (between Bakersfield and Modesto)	41,000	60,000	46
I-5 (between Modesto and Sacramento)	47,000	79,000	68
I-5 (between San Diego and Los Angeles)	229,000	284,000	24
I-5 (between Los Angeles and Bakersfield at Santa Clarita)	182,000	271,000	49
I-5 (between Lancaster and Los Angeles)	324,000	384,000	19

Source: Caltrans 2014
Average daily volume represents average weekday traffic over a 24-hour period
I = Interstate
SR = State Route
US 101 = U.S. Highway 101

Freight Movement

Freight movement in the Bay Area is associated with international trade, domestic trade, and urban goods movement (Caltrans 2014). The region is an important international trade gateway—the Port of Oakland is the fifth busiest port in the U.S. based on cargo volume, the Port of San Francisco specializes in noncontainerized cargo and has a thriving cruise industry, and the Port of Redwood City is the fasted growing “small” bulk port in California (Caltrans 2011, 2012a, 2013c). The Bay Area is also a major consumption center that relies on its domestic trade links to population-serving industries across the country; for instance, the region relies on the San Joaquin Valley for much of the warehouse and distribution infrastructure. The region also relies heavily on a local urban goods movement to provide basic consumer products, foods, and packages to residents and businesses within the region. Unlike passenger trains, freight rail traffic is expected to increase at a compound annual growth rate of 3.5 percent to 2040 because of increased intermodal rail shipments (e.g., shipping containers that can be single- or double-

stacked on railcars, stacked in a container ship, or placed on a truck trailer chassis) coming from the Port of Oakland (Caltrans 2014).

Passenger vehicle travel in the region competes with freight movement along US 101, SR 152, SR 99, and other local roads. Most freight in the region is transported by trucks, with more than 72 percent of the tonnage in the Bay Area transported by trucks in 2012 (MTC 2016). US 101 carries most of the truck traffic in Santa Clara County, and it will continue to be one of the two most significant intraregional goods movement corridors in the San Francisco and South Bay areas. The *MTC San Francisco Bay Area Goods Movement Plan* forecasts increasing conflicts between truck and commuter traffic patterns in this corridor (MTC 2016).

Trucks also transport most of the freight in Merced County. Rail accounts for approximately 6 percent of the total, air transport for less than 0.1 percent (MCAG 2018). Merced County has both agricultural and light industrial demands for trucking. Truck traffic along the major highway corridors makes up between 20 and 30 percent of the vehicular traffic, with SR 99 and I-5 the primary north-south interregional routes. SR 99 is a significant interregional route, carrying most of the truck-transported agricultural goods. Other state highways and county roads also play major roles in distribution.

UPRR operates the freight rail system in the Santa Clara to Madera corridor (via Niles Canyon and Altamont Pass), while the BNSF Railway (BNSF) provides freight movement in and through Merced County. In Santa Clara County, freight trains operate daily on the UPRR Coast Line between San Jose and Gilroy; Caltrain, Amtrak, and Altamont Corridor Express (ACE) passenger services also use the Coast Line. The current combined freight and passenger train volume along this shared corridor is 11–25 trains per day, predominantly Caltrain passenger service. In Merced County, rail freight service is used by several industrial/manufacturing and agricultural companies, with the largest users in the cities of Merced, Atwater, and Los Banos (Caltrans 2018).

Conventional Passenger Rail

Several conventional passenger rail systems serve portions of the Project Section. BART now serves Santa Clara County, as of June 2020, extending service from Warm Springs in Fremont to Berryessa Station in San Jose as part of Phase 1, with a Phase 2 extension through downtown San Jose to Santa Clara anticipated opening date for passenger service in 2030 (BART 2020; Wells 2019). A stop would be provided at the San Jose Diridon Station (VTA 2018a). The existing passenger train services in the study corridor are provided primarily by Amtrak, Caltrain, San Joaquin Joint Powers Authority (SJJPA), and the VTA (Caltrans 2018).

- **Amtrak—**Amtrak provides intercity passenger rail service in California on four principal corridors covering more than 1,300 linear route miles and spanning the length and breadth of the state. The existing passenger rail network in the project vicinity includes portions of three of these corridors: the Coast Starlight follows the UPRR coast route between San Jose and Gilroy; the San Joaquin route follows the BNSF corridor in Madera and Merced Counties; and the Capitol Corridor, which terminates in San Jose, provides service north to Oakland and eventually to Sacramento and Auburn.

  Plans are in development for a 68-mile service expansion of the Capitol Corridor to Santa Cruz and Monterey Counties, stopping at Watsonville, Castroville, and Salinas in addition to Gilroy, San Martin, Morgan Hill, Blossom Hill, Capitol, and Tamien Stations (Capitol Corridor Joint Powers Authority 2015). The expanded service would operate on Caltrain and UPRR track. The service expansion is under study by the Capitol Corridor Joint Powers Authority and the Transportation Agency of Monterey County (TAMC 2014).

- **Caltrain—**Caltrain is managed by SamTrans and operates under the jurisdiction of the PCJPB. The PCJPB's Caltrain service provides regional service between San Francisco and San Jose, with three peak hour/peak direction weekday trips extending to Gilroy, stopping at the Tamien, Capitol, Blossom Hill, Morgan Hill, and San Martin Stations in the evening peak hour. The same stations are served in the northbound direction during the morning peak hours. The PCJPB is a joint exercise of powers agency formed by means of a Joint Powers Agreement among three

entities: the City and County of San Francisco, the San Mateo County Transit District, and the VTA. The San Mateo County Transit District is the Managing Agency of the PCJPB pursuant to the Joint Powers Agreement. The PCJPB owns the rail right-of-way from Tamien Station (CP Lick) to San Francisco 4th and King Station, sharing that ownership within San Mateo County with the San Mateo County Transit District. For its operations south of Tamien, Caltrain utilizes trackage rights it holds over the UPRR-owned right-of-way and stations owned by VTA. The PCJPB has trackage rights agreements in place with the UPRR regarding freight operations over the PCJPB-owned right-of-way from Tamien Station to San Francisco. On a portion of that right-of-way, between CP Coast (near Santa Clara) and Tamien/CP Lick, UPRR owns its own track, known as Main Track 1. PCJPB also has agreements in place for tenant railroads ACE, Capitol Corridor, and Amtrak. These agreements govern their usage of the PCJPB-owned tracks and stations.

- **ACE—**The ACE, operated by the SJJPA, provides passenger service between the San Jose Diridon Station and Stockton (San Joaquin Regional Rail Commission [SJRRC] 2016a). The SJJPA is evaluating the potential environmental impacts of extending the commuter service to Merced (SJRRC 2016b).
- **VTA—**The VTA provides bus, light rail, and paratransit service within Santa Clara County. VTA operates a light rail system serving San Jose and surrounding suburban areas south and east of Diridon Station. The Mountain View–Winchester line serves the San Jose Diridon Station. The VTA also manages the BART Silicon Valley project, which extends from Fremont through the cities of Milpitas, San Jose, and, eventually, Santa Clara (VTA 2016a; BART 2020). The program's first phase connects the Warm Springs BART Station in Fremont to the Berryessa BART Station in San Jose. The second phase would construct a subway tunnel from the Berryessa Station through downtown San Jose and the Diridon Station, terminating service at the Santa Clara Caltrain Station and continuing to a maintenance facility at the Newhall Maintenance Yard (VTA 2016b). The Project Section would connect with BART at the San Jose Diridon Station.

Air Travel

The demand for air travel has been growing steadily in California, and RTPs forecast continued growth in air travel over the coming decades. Between November 2014 and October 2015, Los Angeles to San Francisco was the second busiest air travel route in the United States, with 3.68 million passengers (U.S. Department of Transportation [USDOT] 2016a). Far fewer trips are made to and from the smaller airports in the eastern portion of the project vicinity.

Commercial air service for Santa Clara, San Benito, and Merced Counties is provided primarily by Norman Y. Mineta San Jose International Airport (SJC) and Fresno Yosemite International Airport. Other airports serving the project vicinity include Merced Regional, San Martin Airport, South County Municipal Airport, Frazier Lake Airpark, and Los Banos Municipal Airport; however, these airports do not provide significant intercity commercial airline service to populations in the Central Valley. The HSR system would provide an intercity travel option with frequent, reliable service and competitive fares for the growing populations in the project area.

The Bay Area's two primary medium hub airports—SJC and Oakland International Airport (OAK)—are projected to increase their annual passenger demand from 9.4 million passengers in 2014 to 17.6 million by 2027 at SJC, an 87 percent increase (City of San Jose 2015a), and from 18 million passengers in 2010 to 30 million at OAK by 2025, a 67 percent increase (Port of Oakland 2006). Some projected air travel demand may be absorbed by these medium hub airports and by external airports in the larger market area, such as Sacramento, Stockton, and Monterey airports. However, the external airports offer fewer flights and destination locations than the medium hub airports. Consequently, the external airports are not as attractive to the business commuter or international and national tourist travelers as the medium hub airports.

The HSR system would provide a new intercity travel option for air passengers from the San Francisco Bay Area and Central Valley airports, serving passengers who would normally fly between the Bay Area and Los Angeles, Burbank, and Orange County. The California cities that

would be served by HSR include 5 of the top 15 Bay Area domestic air passenger markets and 26 percent of all domestic passengers served from the three Bay Area airports (Regional Airport Planning Committee 2011). Because of existing constraints to expanding San Francisco International Airport (SFO) and the large hub airports in southern California, regional sharing of air travel among local airports, market mechanisms, and high-speed ground travel modes will be needed to alleviate the demand and capacity constraints.

The HSR system would help to alleviate capacity constraints at Bay Area airports by providing a new mode of intercity transportation. Air passengers would be diverted to HSR by a combination of factors, such as frequent, reliable service, competitive fares, and arriving closer to their final destinations in the commercial centers of cities (rather than in airports situated in outlying areas of these commercial centers).

Travel Time

With growing demand for intercity travel and growing capacity constraints, the total automobile travel time will increase statewide. Table 1-6 shows the approximate total travel time in 2010 and the projected total travel time in 2040 for automobile, air, and rail between various city pairs. These data come from the *San Jose to Merced Project Section Checkpoint A, Project Purpose, Need, and Objectives*, which includes a ridership analysis completed for HSR, using information from regional transportation planning agencies, Caltrans, and current air and conventional rail schedules (Authority and FRA 2016).

Table 1-6 Estimated Total Travel Times (Door-to-Door in Hours and Minutes) between City Pairs by Auto, Air, and Rail (Peak Conditions)

City Pair	Auto[1]		Air[2,3]		Conventional Rail[3]	
	2010	2040	2010	2040	2010[4]	2040[5]
Los Angeles downtown to San Francisco downtown	6:27	6:53	4:37	4:32	11:40	11:29
Fresno downtown to Los Angeles downtown	3:37	3:51	4:03	4:23	5:49	5:55
Los Angeles downtown to San Diego downtown	2:24	2:28	4:11	3:55	3:02	3:24
Burbank (Airport) to San Jose downtown	5:22	5:43	3:43	3:43	10:31	10:40
Sacramento downtown to San Jose downtown	2:22	2:18	4:12	4:25	4:04	3:32

Source: Authority and FRA 2016

[1] Travel times come from California Statewide Travel Demand Model.

[2] Main-mode level-of-service assumptions are the same for 2010 and 2040, and are based on 2009 levels-of-service conditions from U.S. Department of Transportation and Bureau of Transportation Statistics' origin and destination survey airline data. Total travel time differences based on changes in access/egress over time.

[3] Air and conventional rail times include access to main mode via transit, egress to main mode via transit, and terminal and wait time at station/airport. When transit is unavailable, auto is used for access/egress.

[4] Developed from online published San Joaquin schedule.

[5] Year 2040 San Joaquin operating plan developed from the 2013 State Rail Plan (Caltrans 2013a).

Air and rail travel time are not projected to change between 2010 and 2040. While increases in air travel times are not forecast, the number of desired flights to a given destination may be limited by runway capacity, thus reducing flexibility in available travel dates and times.

Projected increases in automobile travel time will be caused largely by growing travel demand and resulting congestion on highways used for intercity travel. Programmed and funded highway improvements will not measurably change these future conditions, and vehicle delays and congestion levels will continue to outpace the network's ability to serve the demand (ABAG and

MTC 2017). Some capacity improvements funded for the San Francisco Bay Area, Central Valley, and Southern California are only basic enhancements that will do more to improve reliability than travel time.

Continuing population growth and increasing tourism in California place severe demands on the already congested transportation system serving the state's major metropolitan areas. As described in the RTPs and acknowledged in the original Tier 1 2005 Statewide Program EIR/EIS (Authority and FRA 2005) and the Tier 1 Bay Area to Central Valley Program EIR/EIS (Authority and FRA 2008) for areas that would be served by the proposed HSR system, the highways and airports serving key cities are currently operating at capacity, and plans for expansion will not keep pace with projected growth over the next 20 to 40 years.

1.2.4.2 Unreliability of Travel

The project vicinity is served primarily by the US 101, SR 152, SR 99, and I-5 freeways. In 2014, freeway travel time during the peak period in the San Francisco–Oakland urban areas took about 1.5 times as long as during low-volume conditions (Urban Mobility Scorecard 2015). This is the second worst performance in California (behind the Los Angeles–Long Beach–Anaheim area) and the fourth worst nationally. In the San Jose area, freeway travel during the peak period took 1.43 times as long as during low-volume conditions. On another index measuring freeway commuter stress, the San Francisco–Oakland urban area ranked worst in the nation (Urban Mobility Scorecard 2015). As congestion worsens, daily peak travel periods will lengthen.

The California Highway Patrol (CHP) publishes an annual summary of accident data for state highways. In 2016, the CHP reported that 3,704 fatalities and 275,813 nonfatal injuries occurred on California's highways (CHP 2017). With more vehicles on the intercity highways, the potential for accidents will continue to increase, resulting in increased travel delays as incidents are cleared. As delays on the freeways increase, overall system reliability tends to decrease. Implementation of HSR in the Project Section would offer a reliable and predictable alternative transportation option to highway travel.

Weather conditions can adversely affect highway travel time reliability. Rain and wind can make the roads dangerously slick, increasing accident rates, while fog and glare can reduce visibility and distract drivers, increasing accident rates. The San Joaquin Valley is subject to dense tule fog during the winter months. The fog creates a substantial safety hazard for motorists and is the leading cause of weather-related accidents in California (USDOT 2016b). Visibility in tule fog is often less than one-eighth of a mile (approximately 600 feet); sometimes visibility can be less than 10 feet, resulting in hazardous driving conditions.

These weather conditions are also a key factor in flight delays, which adversely affect air travel reliability. In 2015, weather caused more than 57 percent of flight delays at SFO, the highest nationally among major airports (USDOT 2016b). SFO capacity is highly dependent on weather conditions and whether aircraft pilots are allowed to follow visual flight rules (in good weather) or instrument flight rules (in poor weather). While fog can also affect rail travel reliability by reducing visibility, HSR trains would be equipped with positive train control to reduce reliance on trackside signaling. Implementing HSR in the Project Section would offer a transportation option that is less affected by weather conditions than driving or flying and, therefore, a more reliable and predictable option.

The reliability of rail travel along the San Jose to Merced corridor is adversely affected by collisions and fatalities primarily associated with the joint use of the rail corridor by passenger and freight rail services, as well as with the proximity of pedestrians and motor vehicles to trains at and along grade crossings. In 2014, California ranked first in pedestrian rail trespass fatalities (with 93 fatalities) (Operation Lifesaver, Inc. 2015a, 2015b, 2015c). In 2015, California ranked second for highway-rail grade crossing collisions in the nation and first for highway-rail grade crossing fatalities (FRA 2016). A total of 50 highway-rail grade crossing collisions occurred in Santa Clara, San Benito, and Merced Counties from January 2011 to December 2015. Between January 2011 and December 2016, 65 at-grade crossing accidents occurred in Santa Clara, San Benito, and Merced Counties. None of these accidents occurred within the Project Section (FRA 2016). Through

November 2016, the FRA reported one highway-rail crossing fatality in San Benito County; two highway-rail crossing fatalities and four pedestrian rail trespass fatalities in Merced County; and one highway-rail crossing fatality and four pedestrian rail trespass fatalities in Santa Clara County (FRA 2017a, 2017b, 2017c). Grade crossing safety is a high priority for the FRA, the Authority, and the California Public Utilities Commission. Dedicated rail facilities from San Jose Diridon Station through the project extent would improve safety by reducing pedestrian, rail, and vehicle conflicts, thereby increasing the reliability of travel along this corridor.

1.2.4.3 Limited Modal Connections

Statewide, modal connections among intercity travel facilities (primarily airports) and the extensive network of urban and commuter transit systems are often limited or cumbersome, involving multiple transfers and long waits, though improvement has been made in recent years. Moreover, the automobile is still the primary mode of transportation in the San Jose to Merced corridor. Passengers prefer transportation systems with connections that perform similarly to the convenience and speed of door-to-door service by auto. If multiple mode changes (e.g., from car to shuttle to plane to train) are needed to reach a destination, travelers might prefer to travel by car, even if travel times are comparable.

In San Jose, the Diridon Station provides transit connectivity among Caltrain, VTA buses and light rail routes, the Capitol Corridor (intercity passenger rail service between Sacramento and San Jose), ACE trains (commuter rail service between Stockton in the Central Valley and San Jose), and Amtrak service (connecting the Bay Area with Southern California). In addition, the planned BART extension to Diridon Station will provide transit connectivity around the San Francisco Bay Area. Gilroy Transit Center provides transit connectivity among VTA bus lines, San Benito County Transit shuttles, Monterey-Salinas Transit buses, Amtrak Thruway buses, and Caltrain commuter trains. Providing HSR service at the Diridon Station and Gilroy Transit Center would expand intercity modal connections to the Central Valley and Southern California.

Presently, there are no direct transit connections linking Merced to Gilroy or San Jose. Traveling from Merced to San Jose currently requires a combination of transit modes: the Amtrak San Joaquin line, BART, bus, and Caltrain, taking approximately 5 hours. By comparison, auto travel time between San Jose and Merced is nearly 2 hours. The SJRRC is currently planning improvement and expansion of existing rail service between Stockton and San Jose, with later extension to Modesto by early 2019 and ultimately downtown Merced (SJRRC 2016b). HSR service from San Jose to the Central Valley would provide a direct transit linkage from Merced to San Jose, with a projected travel time of approximately 40 minutes.

The limited options for direct, fast, and safe connections to the major metropolitan areas isolate the Central Valley economically, limit the area from which the Central Valley economy can draw consumers and employees, and reduce the accessibility of job markets for residents. HSR service between San Jose, Gilroy, and Merced would provide an effective mobility option at these locations by providing linkages to a number of bus, light rail, and airport services for intercity travelers to other areas in the state.

1.2.4.4 Deterioration of Air Quality and Impact on Greenhouse Gas Emissions

Under the authority of the Clean Air Act, the USEPA established nationwide air quality standards to protect public health and welfare with an adequate margin of safety. The federal standards (National Ambient Air Quality Standards) represent the maximum allowable atmospheric concentrations for ozone (O_3), particulate matter (particulate matter smaller than or equal to 10 microns in diameter [PM_{10}] and particulate matter smaller than or equal to 2.5 microns in diameter [$PM_{2.5}$]), carbon monoxide, nitrogen dioxide, sulfur dioxide, and lead. The Clean Air Act defines nonattainment areas as geographic regions designated as not meeting one or more of the National Ambient Air Quality Standards. The Clean Air Act requires that a state implementation plan be prepared for each nonattainment area and a maintenance plan be prepared for each former nonattainment area that subsequently demonstrates compliance with the standards. A state implementation plan is a compilation of a state's air quality control plans and rules that the USEPA has approved.

California has multiple air basins that contain nonattainment areas due to one or more violation of the state's ambient air quality standards (see Section 3.3, Air Quality and Global Climate Change), including the Great Basin Valleys, Lake Tahoe, Mojave Desert, Mountain Counties, North Central Coast, North Coast, Northeast Plateau, Sacramento Valley, Salton Sea, San Diego, San Francisco Bay Area, San Joaquin Valley, South Central Coast, and South Coast Air Basins (California Environmental Protection Agency 2016).

Metropolitan areas will continue to be challenged by the growing number of vehicles to reduce emissions to acceptable levels. Jurisdictions will attempt to maintain air quality standards by encouraging more efficient use of land resources, improving mobility, and providing alternative transportation facilities and services. Policies aimed at reducing the trip demand in single-occupant vehicles are integral to all transportation plans and programs to help areas currently in nonattainment status to conform to federal air quality standards. The Bay Area exceeds federal and state air quality standards for O_3 and fine particulate matter ($PM_{2.5}$) and the state standard for particulate matter (PM_{10}) (Bay Area Air Quality Management District 2017). San Benito County, which is within the North Central Coast Air Basin (managed by the Monterey Bay Unified Air Pollution Control District), exceeds state standards for O_3 and PM_{10} (Monterey Bay Unified Air Pollution Control District 2008). Merced and Madera Counties, which are within the San Joaquin Valley Air Pollution Control District, exceed federal and state standards for O_3 and $PM_{2.5}$ and the state air quality standard for PM_{10} (San Joaquin Valley Air Pollution Control District 2015). The projected population growth in the Bay Area and Central Valley will result in an increase in VMT and thus in the volume of pollutants emitted by motor vehicles.

One statewide strategy adopted in the CARB's State Implementation Plan is the development of multiuse transportation corridors. These corridors include designated high-occupancy vehicle lanes, the addition of more transit, and the inclusion of rail modal options. To meet federal and state air quality standards over the next 20 to 40 years, the Bay Area and Central Valley will need to require VMT reductions, integrated land use and transportation planning and development, transportation demand strategies, operational improvements, and new technologies that improve transportation efficiencies and increase transportation alternatives to the single-occupant automobile. The electric-powered HSR system offers an additional transportation option to the single-occupant vehicle and would reduce VMT in support of the California State Implementation Plan.

In 2005, California's governor set statewide targets for reducing GHG emissions. Executive Order S-3-05 requires that state agencies reduce their GHG emissions to 2000 levels by 2010, to 1990 levels by 2020, and 80 percent below 1990 levels by 2050. Shortly after the issuance of Executive Order S-3-05, the California State Legislature adopted AB 32, the Global Warming Solutions Act of 2006. AB 32 recognizes that California is the source of substantial amounts of GHG emissions. Legislative findings in the law state the following:

> *The potential adverse impacts of global warming include the exacerbation of air quality problems, a reduction in quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to the marine ecosystems and that natural environment, and an increase in the incidences of infectious diseases, asthma, and other health-related problems.*

To avoid these consequences, AB 32 requires CARB, the state agency charged with regulating air quality, to create a plan and implement rules to achieve real, quantifiable, cost-effective reductions of GHGs in California. AB 32 requires CARB to design and implement emissions limits, regulations, and other measures to reduce statewide GHG emissions to 1990 levels by 2020. This requirement is the same 2020 target as in Executive Order S-3-05. The Legislature has not enacted targets beyond 2020. In response to this legislation, CARB developed the 2008 Climate Change Scoping Plan, the state's road map to reaching the GHG reduction goals required by AB 32 (CARB 2008). The original 2008 Scoping Plan supported the implementation of an HSR system to provide more mobility choice and reduce GHG emissions. A 2017 Final Scoping Plan furthers support for HSR implementation by calling for investment in the cleanest,

most advanced systems and infrastructure to move people and goods statewide to meet California's long-term air quality and climate objectives (CARB 2017).

In April 2015, Governor Brown issued Executive Order B-30-15, setting an interim 2030 target of 40 percent below 1990 levels for GHG reductions. On August 24, 2016, SB 32 (Pavley) mandated reduction of GHG emissions to 40 percent below 1990 levels by 2030 for the state of California. The new bill sets a cap on emissions for 2030 without actually shifting the final reduction goals in 2050. It provides an intermediate goal to hasten GHG reduction efforts. The 2017 Scoping Plan (adopted in December 2017) includes plans to achieve goals set forth by SB 32 (CARB 2017). HSR is a component of the statewide approach to GHG reductions from California's transportation system (CARB 2017).

SB 100, the 100 Percent Clean Energy Act of 2018, makes it a policy of the state that eligible renewable energy resources and zero carbon resources supply 100 percent of all retail sales of electricity to California end-use customers and 100 percent of electricity procured to serve all state agencies by December 31, 2045 (CARB 2018).

SB 375, which became law in September 2008, provides a new planning process to coordinate the community development and land use planning process with RTPs. SB 375 sets priorities to help California meet GHG reduction goals and requires the RTPs prepared by metropolitan planning organizations (MPO) to include a "sustainable communities strategy" or, if infeasible, an "alternative planning strategy" that would support the GHG emission reduction targets for automobiles and light trucks set by CARB. On July 26, 2017, MTC adopted the latest RTP for the area: *Plan Bay Area 2040—Final* (ABAG and MTC 2017), which specifies how approximately $303 billion in anticipated federal, state, and local transportation funds will be spent in the nine-county Bay Area during the next 25 years.

Metropolitan planning organizations (MPO)

MPOs are federally mandated and funded transportation policy–making organizations made up of representatives from local government and governmental transportation authorities. Comprising representatives from nine counties, the MPO for the San Francisco Bay Area is the Metropolitan Transportation Commission (MTC). The portion of the San Jose to Merced Project Section located in Santa Clara County is within the MTC's planning area.

Carbon dioxide (CO_2) is the transportation sector's primary contribution to climate change, accounting for 37 percent of California's GHG emissions from 2000 to 2013 (CARB 2015). CO_2 emissions from motor vehicles are essentially proportional to the amount of fuel consumed—each 1 percent increase in fuel consumption results in a corresponding 1 percent increase in CO_2 emissions (USEPA 2008). The projected population growth in Santa Clara, San Benito, and Merced Counties will result in an increase in VMT and the volume of GHGs emitted by motor vehicles. Particulate emission levels are a direct function of the amount of driving, with road dust caused by moving vehicles accounting for 60 to 80 percent of particulate emissions from mobile sources. Motor vehicle exhaust is a major source of fine particulates and the precursors to O_3. Continued increases in vehicle traffic will exacerbate existing air quality problems and impede the region's ability to attain state and federal ambient air quality standards. Because emissions are directly proportional to the amount of fuel burned, offering effective transportation choices that can reduce driving will be critical for reducing these emissions.

An electric-powered HSR system would reduce CO_2 emissions relative to travel by car. Emissions reductions are projected to start at almost 120,000 metric tons of carbon dioxide equivalent (CO_2e) with operation of the initial Silicon Valley to Central Valley line. With buildout of the Phase 1 system through 2040, average annual emissions reductions are projected to be over 1 million metric tons of CO_2e (Authority 2016). The HSR system would also provide a more energy-efficient mode of travel.

1.2.4.5 Deterioration of Natural Resources and Agricultural Lands

In addition to improving or maintaining the state's air quality, the protection and preservation of natural resources by limiting potential impacts related to expanding freeway and airport facilities

is also a critical need. Key resources affected by expanded transportation corridors include wetlands and waterways, habitat areas for sensitive species of plants and animals, wildlife migration corridors, and agricultural lands. These natural resources have been subject to both direct and indirect impacts as the population has increased and growth has occurred in the state's less developed areas. Avoiding and minimizing impacts on sensitive natural resources is a guiding criterion in the environmental review process of the HSR system. The HSR system would provide intercity travel capacity to supplement overused interstate and state highways and commercial airports, thereby limiting the need for constructing new freeway and airport facilities.

In California, new development has consumed an acre of agricultural land for every 9.4 people statewide. In the Bay Area, due to higher density development, this rate is an acre for every 9.7 persons (Thompson et al. 2008). The projected population growth and transportation demands in Santa Clara, San Benito, Merced, and Madera Counties will generate ongoing pressure to convert undeveloped lands to urban uses. The project would ease the pressure to develop open space, and thereby preserve natural resources, by emphasizing the use of existing transportation rights-of-way and focusing new development around stations to foster the creation of compact, walkable, mixed-use communities at these stations. The Project Section would expand rail capacity at the San Jose Diridon Station to accommodate HSR. Station area planning by the local communities to increase development densities is already underway for the areas adjacent to the San Jose Diridon and Gilroy Stations. Increasing densities through transit-oriented development would reduce the pressure to consume open space, potential habitat for special-status species, and prime and important farmland. Station area development planning at San Jose Diridon and Gilroy Stations would provide housing, employment, and entertainment opportunities, while minimizing impacts on sensitive natural resources.

1.2.4.6 Public Benefits of the High-Speed Rail System to the Region

The HSR system would provide numerous benefits to the entire region, including environmental, economic, and social benefits. Among the public benefits that the HSR system would provide are the following:

- **Increasing mobility options**—Presently, there are no direct transit connections linking Merced to Gilroy or San Jose. Traveling from Merced to San Jose currently requires a combination of transit modes: the Amtrak San Joaquin line, BART, bus, and Caltrain, taking approximately 5 hours. By comparison, auto travel time between San Jose and Merced is nearly 2 hours. As described in Section 1.2.4.3, Limited Modal Connections, HSR service from San Jose to the Central Valley would provide a direct transit linkage from Merced to San Jose, with a projected travel time of approximately 40 minutes.
- **Contributing to a cleaner environment**—The projected population growth in the region will result in an increase in VMT, and thus in the volume of pollutants emitted by motor vehicles. As described in Section 1.2.4.4, Deterioration of Air Quality and Impact on Greenhouse Gas Emissions, the electric-powered HSR system would reduce VMT in support of the California SIP, thereby contributing to a decrease in the emissions of harmful air pollutants, such as particulate matter, carbon monoxide, and nitrogen oxide. The average annual GHG emissions savings provided by the HSR system, which would equate to over 1 million metric tons of CO_2e (Authority 2016), is equal to taking 322,000 passenger vehicles off the road every year.
- **Stimulating economic activity and creating jobs**—The investment in the HSR system has, over an 11-year period from 2006 to 2017, generated between $5 billion and $6 billion in total economic activity in the state (Authority 2018a). Over the last 2 years, the Authority, working with partner agencies, was allocated and received authorization from the CDOF to use nearly $700 million in Prop 1A bond funds for improvements to existing rail lines within certain sections of the system to allow HSR to "blend" operations with other users.
- **Minimizing open space conversion**—The HSR system would increase intercity travel capacity, which is presently stressed by heavy use of the interstate and state highway systems and commercial airports. As described in Section 1.2.4.5, Deterioration of Natural

Resources, this increased capacity would reduce the need for new freeways and airport facilities, thereby reducing impacts on ecologically important areas that would be associated with the development of new infrastructure.

- **Improving safety and security**—The Project Section would be built according to international safety guidelines and would include several key safety mechanisms, such as positive train control (PTC), safety improvements at existing Caltrain stations, perimeter fencing, and four-quadrant gates at at-grade crossings. These improvements are expected to alleviate a number of safety concerns related to the existing Caltrain tracks.

1.3 Relationship to Other Agency Plans, Policies, and Programs

The objectives of the California HSR System include providing an interface between the HSR system and major commercial airports, mass transit, and the highway network. This section describes plans and programs that have been considered in the development of the Project Section alignment and station location options, or that already include recommendations for an HSR project.

1.3.1 California Transportation Plan 2040

The *California Transportation Plan 2040* (CTP 2040) (Caltrans 2016b) provides a long-range policy framework for guiding transportation decisions and investments by all levels of government and the private sector. CTP 2040 (Caltrans 2016b) defines goals, performance-based policies, and strategies to achieve the collective vision for California's future statewide, integrated, multimodal transportation system, envisioning a sustainable system that improves mobility and enhances quality of life. Federal and state laws require developing and preparing a state transportation plan and an update to the plan every 5 years.

The CTP 2040 was adopted in June 2016, and was originally initiated in early 2010 with the development of the California Interregional Blueprint (Caltrans 2012b) in response to SB 391, which requires Caltrans to update the California Transportation Plan every 5 years. The California Interregional Blueprint is a state-level transportation blueprint that articulates the state's vision for an integrated multimodal transportation system that complements RTPs and land use visions and provides the foundation for the CTP 2040 (Caltrans 2016b), which concluded with the plan's approval by the secretary of the California State Transportation Agency.

The CTP 2040 update focuses on meeting new trends and challenges, such as economic and job growth, climate change, freight movement, and public health. The HSR system would support CTP 2040 goals, policies, and strategies by providing an efficient and reliable means of transportation that facilitates economic and job growth by providing electric-powered transportation that reduces GHG and air pollutants that contribute to climate change, and by providing some relief to California's strained highway and rail systems.

1.3.2 Plan Bay Area 2040

Plan Bay Area 2040 (ABAG and MTC 2017), adopted in July 2017, is the Bay Area's response to SB 375, which requires the state's MPOs to develop an SCS to reduce GHG emissions from passenger vehicles. *Plan Bay Area 2040*, developed by the MTC and ABAG, serves as the region's joint RTP/SCS, integrating transportation and land use strategies to manage GHG emissions and plan for future population growth. This plan identifies climate protection and transportation system effectiveness as two key goals. The climate protection goal is to reduce per-capita CO_2 emissions, and the transportation system effectiveness goal is to increase non-auto mode share, reduce vehicle operating and maintenance costs due to pavement conditions, and reduce per-rider transit delay due to aged infrastructure. The electric-powered HSR system would reduce GHG emissions and provide a more energy-efficient transportation mode in support of SB 375 and *Plan Bay Area 2040* climate and transportation system effectiveness initiatives.

The BART extension to San Jose/Santa Clara, Caltrain Electrification, and the Salesforce Transit Center and Downtown Extension are three of the major transit projects included in *Plan Bay Area 2040* (ABAG and MTC 2017). These transit projects are supported by the HSR system, which

would provide connections to BART service in San Jose and along the Caltrain corridor, contribute funding to electrification of the corridor, share corridor use with Caltrain, and provide connections to other local and regional transit services at the Salesforce Transit Center.

1.3.3 San Francisco Bay Area Regional Rail Plan

The *San Francisco Bay Area Regional Rail Plan* (MTC 2007), adopted by MTC in September 2007, presents a long-term vision for improving the passenger rail system to serve future Bay Area travel demand. MTC joined with BART, Caltrain, and the Authority to develop the plan. The Regional Rail Plan examines ways to incorporate passenger trains into existing rail systems, improve connections to other trains and transit, expand the regional rapid transit network, increase rail capacity, and coordinate rail investment around transit-friendly communities and businesses. Prepared prior to the Bay Area to Central Valley Program EIR/EIS (Authority and FRA 2008), the Regional Rail Plan explores three possible regional rail scenarios, including regional rail without HSR, regional rail with HSR entering from the east (Altamont Pass), and regional rail with HSR entering from the south (Pacheco Pass). Overall, the plan looks at improvements and extensions of railroad, rapid transit, and HSR services for the near-term (5 to 10 years), intermediate (10 to 25 years), and long-term (beyond 25 years) time frames.

The Regional Rail Plan specifically acknowledges the opportunity for HSR to enhance and accelerate regional rail improvements, noting that "a statewide high-speed train network would enable the operation of fast, frequent regional services along the high-speed lines and should provide additional and accelerated funding where high-speed and regional lines are present in the same corridor." The plan also acknowledges that limited-stop high-speed trains could operate along the San Francisco Peninsula Corridor along with continued operation of local services. The project would help satisfy multiple objectives of the Regional Rail Plan by incorporating HSR passenger trains into existing rail systems, improving transit connections, expanding the transit network, and increasing rail capacity.

1.3.4 Authority Agreements with Peninsula Corridor Joint Powers Board and Other Agencies Regarding Blended Service in the Caltrain Corridor

1.3.4.1 MTC Resolution No. 4056 Memorandum of Understanding

MTC Resolution No. 4056 (MTC 2012), adopted in March 2012, approves a MOU summarizing the agreement among the MTC, the Authority, the PCJPB, the San Francisco County Transportation Authority, the San Mateo County Transportation Authority, the VTA, the City of San Jose, the City and County of San Francisco, and the Transbay Joint Powers Authority to:

- Jointly support and pursue the implementation of a statewide HSR system that utilizes a blended system and operational model on the San Francisco Peninsula Corridor with its northern terminus at the Transbay Transit Center in San Francisco and its southern limit at Mile Post 51.4 at the Caltrain Tamien Station in San Jose (in the San Jose to Central Valley Wye Project Extent study area).
- Jointly recognize a defined set of interrelated projects consistent with the Authority's phased implementation plan, consistent with blended-system operation of the corridor, that achieve objectives including system capacity and connectivity for Caltrain, HSR, and freight; public safety; and operational efficiency, effectiveness, and connectivity.
- Generally describe, identify, and work to fully fund an interrelated program of projects, including the Caltrain corridor electrification project; advanced signal system (positive train control); the downtown extension to Transbay Transit Center; and a core capacity project of needed upgrades to stations, tunnels, bridges, potential passing tracks, and other track modifications and rail crossing improvements.

1.3.4.2 2016 Agreement Regarding Funding Commitments toward Peninsula Corridor Electrification Project between the Authority and Peninsula Corridor Joint Powers Board

In 2016, the Authority and the PCJPB signed an agreement that required the Authority to dedicate $600 million in Proposition 1A funding for the Peninsula Corridor Electrification Project (PCEP), required additional Authority and/or other state funding of $113 million for the PCEP, and established certain terms of cooperation between the Authority and the PCJPB to cooperate in realizing blended service in the Caltrain Corridor (Authority and PCJPB 2016). The Agreement does not describe a specific Caltrain or HSR level of service, instead referring to blended service consistent with the Authority's 2014 Business Plan (Authority 2014) and the simulations deemed feasible in the prior 2012 Caltrain/Authority Blended Operations Analysis (Caltrain 2012).

1.3.4.3 2018 Project Management and Funding Agreement between the Authority and Peninsula Corridor Joint Powers Board

The 2018 Project Management and Funding Agreement (PMFA) between the Authority and the PCJPB provides further detail concerning the $600 million in Proposition 1A funding and further detail regarding the obligations of PCJPB in completing the PCEP, the obligations of the Authority regarding the HSR project, and the obligations and responsibilities of both parties concerning implementing blended service (Authority and PCJPB 2018). The 2018 PMFA recognizes that, after completion of the PCEP, any associated electrification elements, and a positive train control system, there would be eight electric train slots per hour per direction, including two guaranteed HSR train slots per hour per direction (implying six Caltrain train slots per hour per direction). The 2018 PMFA recognizes that HSR may occupy 2 additional train slots per hour per direction (for a total of 10 train slots, including 4 HSR train slots and 6 Caltrain train slots per hour per direction), with the understanding that through the blended system planning process, the PCJPB and the Authority would determine whether additional capital investments in the Caltrain Corridor would be necessary to support that level of service. The project improvements included in the PCEP (which is currently in construction) as well as the improvements included in the alternatives evaluated in this EIR/EIS are sufficient to accommodate the four HSR train slots and the six Caltrain train slots. The 2018 PMFA describes that allocation of train slots beyond the 10 slots addressed in the PMFA would be determined through the blended system planning process and future agreements.

1.3.4.4 Valley Transportation Plan 2040

The VTP 2040 (VTA 2014a) is the countywide long-range transportation plan for Santa Clara County prepared by VTA, which also acts as the congestion management agency for the county. VTP 2040 provides location-specific improvements in three major program areas: highways, local system, and transit. The highways program includes major freeway improvements, local freeway interchanges, and express lanes. The local system includes local roadway improvements, expressway improvements, pedestrian and bicycle projects, and technology-related projects. The transit program includes projects related to transit efficiency and new transit improvements. The VTP 2040 capital investment program includes Caltrain and HSR station improvements at San Jose Diridon Station to accommodate HSR. Additional investments in the Peninsula Corridor were established through MTC Resolution No. 4056 and the associated MOU to prepare the corridor for implementation of blended Caltrain and HSR operations in the future. VTA was one of the agencies involved in establishing the investment framework for modernizing the Peninsula Corridor that was formalized in the MTC Resolution No. 4056 MOU.

Implementing HSR along the Peninsula Corridor is anticipated in VTP 2040 through funding allocations and VTA participation in MTC Resolution No. 4056. HSR would support the vision of VTP 2040 by increasing multimodal transportation infrastructure and services and providing benefits to air quality, while reinforcing the link between transportation and land use planning. Providing HSR at the San Jose Diridon Station would enhance the utility and connectivity of VTP 2040's planned transit investments, connecting HSR service to regional rail services such as

Caltrain, ACE, Capitol Corridor, and Amtrak Coast Starlight; VTA light rail; eight VTA bus routes; and Greyhound and Santa Cruz Metro bus lines.

1.3.5 Caltrain Strategic Plan 2015–2024

Train headways

Headways are the time between arrivals of trains moving in the same direction.

Caltrain provides inter- and intra-county commuter rail service along the Peninsula, including San Francisco, San Mateo, and Santa Clara Counties. The PCJPB operates Caltrain 365 days a year, with reduced schedules on weekends and major U.S. holidays. The current weekday Caltrain operating schedule comprises a mix of 92 express (Baby Bullet), limited, and local trains. Scheduled headways vary by time of day, station, and service type. Overall, service is frequent during the peak periods and is provided every hour in both directions during midday periods. Caltrain now carries an average weekday ridership of more than 58,000 (Caltrain 2015: page 3). In 2012, the MTC, the Authority, Caltrain, and six other San Francisco Bay Area funding partners entered into an agreement, MTC Resolution No. 4056 (MTC 2012), to support the blended system and to invest in the Caltrain Modernization Program.

The *Caltrain Strategic Plan—FY 2015–2024* (Caltrain 2014a) was developed in the context of the Caltrain Modernization Program. Over the coming decade, the Caltrain Modernization Program will electrify and upgrade the performance, operating efficiency, capacity, safety, and reliability of Caltrain's commuter rail service through the delivery of several key projects. This effort includes replacement of most of Caltrain's diesel trains with high-performance electric trains and the implementation of an advanced signal system that includes federally mandated safety improvements.

1.3.6 On the Move—San Benito Regional Transportation Plan (2018–2040)

The *San Benito Regional Transportation Plan* (Council of San Benito County Governments [CSBCG] 2018) presents a blueprint for addressing countywide transportation issues in San Benito County. The plan identifies the existing transportation conditions and identifies future needs based on growth, previously approved plans, public input, and prior Council of Governments Board action. The goal of the San Benito RTP (CSBCG 2018) is to identify a clear direction for maintaining the transportation network in San Benito County and expanding the network to include more roadway capacity and improved access for all users, including pedestrians and bicyclists, other modes of transportation, and public transit.

Although no direct commuter rail service from San Benito County to Santa Clara County exists, County Express provides intercounty shuttle service to connect commuters to Caltrain services in Gilroy. The San Benito RTP (CSBCG 2018) acknowledges the HSR route that would go through northern San Benito County and notes that no stop is planned in San Benito County. The San Benito RTP (CSBCG 2018) also proposes placing a priority on investing in public transit, with a potential bus rapid transit or shuttle project providing linkage to the proposed HSR station in Gilroy.

1.3.7 San Joaquin Valley Blueprint Roadmap Summary

In January 2006, the councils of government from the eight San Joaquin Valley counties (San Joaquin, Stanislaus, Merced, Madera, Fresno, Tulare, Kings, and Kern) jointly received a grant from the California Department of Business, Transportation, and Housing and the San Joaquin Valley Air Pollution Control District to develop a long-term blueprint for growth in the San Joaquin Valley. This effort resulted in the San Joaquin Valley Blueprint Roadmap Summary (Blueprint). The goal was to identify alternatives to current transportation improvement priorities that would improve regional travel patterns and air quality, while being consistent with local attitudes and values.

On April 1, 2009, the San Joaquin Valley Regional Policy Council reviewed the collaborative work of seven councils of government (San Joaquin, Stanislaus, Merced, Fresno, Tulare, Kings, and Kern) and one regional transportation planning agency (Madera County Transportation Commission) on the Blueprint and took the following actions:

- Adopted a list of smart growth principles to be used as the basis of blueprint planning in the San Joaquin Valley.

- Adopted a preferred blueprint growth scenario (Scenario B+) for the San Joaquin Valley to the year 2050. The preferred scenario will provide guidance for local jurisdictions with land use authorities as they update their general plans.

One of the smart growth principles adopted by the Policy Council is to provide a variety of transportation choices. As part of this smart growth principle, the Blueprint envisions HSR service in the San Joaquin Valley, with stations in Merced, Fresno, the Kings/Tulare region, and Bakersfield. The Blueprint is expected to be implemented through collaborative local and regional programs and planning processes and through projects built by private sector developers.

1.3.8 San Joaquin Corridor Strategic Plan

The *San Joaquin Corridor Strategic Plan* (Caltrans 2008) formalized the short-term (3 to 5 years), medium-term (6 to 10 years), and long-term (11 to 25 years) vision for passenger rail service in the Central Valley. The San Joaquin Rail Committee, established in 1987, includes representatives from 13 counties along the San Joaquin train route: Alameda, Contra Costa, Fresno, Kern, Kings, Los Angeles, Madera, Mariposa, Merced, Sacramento, San Joaquin, Stanislaus, and Tulare. The Committee's focus is on possible service improvements, tracking progress, acting as an advisory council, and maintaining cooperative relationships with stakeholders and interested parties. The purpose of the plan is to develop a program of improvements that will increase rail ridership, revenue capacity, reliability, and safety within the corridor. Key stakeholders involved in the development of the plan included Amtrak, BNSF, UPRR, and the San Joaquin Valley regional transportation planning agencies. Public input on the plan suggested: (1) improving communications regarding passenger services and ensuring station safety and security in the short term, (2) adding more frequent service and more stations in the medium term, and (3) providing passenger rail in the UPRR corridor and direct connections to Los Angeles and the Bay Area in the long term.

1.3.9 Regional Transportation Plan and Sustainable Communities Strategy for Merced County

Following passage of SB 375 in 2008, MPOs must develop an SCS for meeting GHG emissions targets as part of their RTPs or, if the target cannot be met, they must adopt an alternative planning strategy separately from the RTP. The SCS demonstrates an ambitious yet achievable approach to how land use development and transportation can work together to meet GHG emissions reduction targets for cars and light trucks. These targets, which the CARB set in 2010, call for the region to reduce per capita emissions by 5 percent by 2020 and 10 percent by 2035.

On May 23, 2018, the MCAG released the *Draft Regional Transportation Plan and Sustainable Communities Strategy for Merced County* (Merced County RTP) and in August 2018, the Final Draft of the Merced County RTP was released (MCAG 2018). Implementation of the Merced County RTP would result in transit projects in the county, such as bus and rail, receiving approximately $624 million in funding through 2040, of which approximately $376 million would be spent on active transportation (bicycle and pedestrian) projects (MCAG 2018). The Merced County RTP contains a fiscally constrained list of projects and programs that have a reasonable expectation of being funded during the life of the plan. Projects seeking state or federal funding, completing environmental clearances, or hoping to begin construction must be included on the RTP list. In turn, the RTP helps inform the development of the State Transportation Improvement Program, which prioritizes the use of state transportation funds. The RTP notes that Merced County is participating in the HSR planning process.

The Merced County RTP supports growth that enhances multimodal transportation and connectivity. Other major goals include developing a safe and efficient regional road system that accommodates the demand for movement of people and goods, developing a rail system that provides safe and reliable service for passengers, and providing economical and long-term solutions to transportation problems by encouraging community designs that encourage walking, transit, and bicycling (MCAG 2018). Major projects on the RTP list that would coordinate with the California HSR System include widening SR 99 and other associated interchange improvements.

With implementation of the 2018 Merced County RTP, the region can meet or even exceed the GHG emissions reduction target set by SB 375 for Merced.

The transportation analysis included in this Final EIR/EIS is based on the 2018 Merced County RTP (MCAG 2018). The 2018 Merced County RTP is the current version available at the time of the analysis.

1.3.10 Madera County Transportation Commission 2018 Regional Transportation Plan

On March 20, 2019, the Madera County Transportation Commission adopted the *2018 Regional Transportation Plan/Sustainable Communities Strategy Amendment No. 1* (Madera County RTP) (Madera County Transportation Commission 2019), which states that the revenue available for funding proposed transportation projects through 2042 is approximately $1.6 billion. The Madera County RTP contains a fiscally constrained list of projects and programs that have a reasonable expectation of being funded during the life of the plan. Projects seeking state or federal funding, completing environmental clearances, or hoping to begin construction must be included in the RTP list. In turn, the RTP helps inform the development of the State Transportation Improvement Program. The Madera County RTP notes that Madera County is participating in the HSR planning process.

The Madera County RTP envisions an integrated multimodal transportation system that considers land resource management strategies and air quality and GHG emissions reduction goals or targets to address SB 375 SCS requirements. The Madera County RTP notes that, with the 2018 improvements to the plan, the region can meet and even exceed the GHG emissions reduction target for Madera County. Major goals of the Madera County RTP include promoting fully accessible and intermodal transportation systems that encourage quality growth and development and foster economic competitiveness; identifying reliable transportation choices that support a diverse population; improving the quality of the environment through regional cooperation of planning activities; and protecting the health of residents by improving air quality and encouraging active transportation (Madera County Transportation Commission 2019). Major projects on the RTP list that would coordinate with the HSR system include widening SR 99 from four to six lanes through Madera County and other associated interchange improvements.

The transportation analysis included in this Final EIR/EIS is based on the 2018 Madera County RTP (Madera County Transportation Commission 2019). The 2018 Madera County RTP is the current version available at the time of this analysis.

1.3.11 ACE Extension Lathrop to Ceres/Merced

The ACE trains connect the Central Valley to the Santa Clara Valley via the Altamont Pass and Alameda County. The ACE operates on an 86-mile UPRR corridor and provides four round-trip trains per day between Stockton and San Jose. Two stations—Santa Clara and Diridon—overlap service with Caltrain.

The SJRRC proposed expanding ACE service to Ceres and Merced. The focus of the ACE Extension Lathrop to Ceres/Merced (referred to as the ACE Extension) is to enhance intercity and commuter rail service and to promote greater transit connectivity between the Central Valley and the San Francisco Bay Area. ACE will serve an important role as feeder service to the HSR system. SJRRC proposes the ACE Extension system improvements in two phases. During Phase I of the ACE Extension, ACE would be extended between Lathrop and Ceres and commuters would be able to transfer to one of the round-trip trains between Stockton and San Jose. During Phase II, ACE would be extended between Lathrop and Merced and commuters would be able to transfer to one of the round-trip trains between Stockton and San Jose. The Notice of Determination was released in August 2018, approving the proposed project.

1.3.12 Valley Link

No direct rail connection currently exists between ACE and BART. The Tri-Valley–San Joaquin Valley Regional Rail Authority is proposing the Valley Link Project, which would bridge this gap

and establish rail service from the existing Dublin/Pleasanton BART station to the proposed ACE North Lathrop Station.[10] The purpose of this project is to improve rail connectivity between BART and ACE; improve connection within the Bay Area megaregion[11]; and support the vision of the California State Rail Plan to connect the Northern California megaregion to the state rail system.

1.3.13 Capitol Corridor 2014 Vision Plan Update

The Capitol Corridor operates 15 daily round-trip trains between Sacramento and the Bay Area; all trains provide service to Jack London Square in Oakland and seven of the trains continue service south to San Jose. Two stations—Santa Clara and Diridon—overlap service with Caltrain. The Capitol Corridor currently carries approximately 1.4 million annual passengers.

The *Capitol Corridor 2014 Vision Plan Update* (Capitol Corridor Joint Powers Authority 2014) maps out a strategy and identifies system improvements to provide a modern railroad built to international standards and capable of operating at speeds of up to 150 miles per hour. This rate of speed could reduce travel times between Sacramento and San Jose to 90 minutes. The Capitol Corridor would be part of an intercity rail passenger coalition that would provide complementary service in corridors in which HSR operates and would branch off HSR to extend rail service to smaller cities in the state.

Capitol Corridor short-term improvements would focus on increasing the number of trains between Oakland and San Jose from 7 to 11 daily round-trip trains. Mid-term improvements would expand service from 11 to 15 daily round trips between Oakland and San Jose. Long-term improvements are focused on options for greater separation of freight and passenger service. Several options have been identified for further consideration, including a potential shift of passenger service to the east as it passes from the Diridon Station north to Fremont and Union City. Long-term improvements would also include additional infrastructure improvements, such as automatic train control, signal improvements, tilting rolling stock, electrification, and express train service.

1.3.14 Bay Area Rapid Transit Vision Update

BART connects San Francisco to Alameda and Contra Costa Counties in the East Bay and the peninsula cities in San Mateo County. The 104-mile heavy-rail rapid transit system operates on 5 routes with 45 stations. The BART Silicon Valley Extension, managed by the VTA, is a program of improvements in the Silicon Valley Rapid Transit Corridor that will extend BART service into Santa Clara County. The first phase of the 16-mile extension, the Berryessa Extension, provides service to Berryessa Station in San Jose as of June 2020. The second phase of the extension will provide service to Diridon and Santa Clara Stations, where it will overlap with Caltrain service (VTA 2018a).

The *BART Vision Update* (BART 2014) focuses on BART's longer-term future to determine where BART should focus investments. In service since 1972, BART developed the Vision Update (BART 2014) in the context of the aging BART system. The *BART Vision Update* identifies railcar replacement; train control system modernization; and construction of a new, state-of-the-art maintenance and storage facility in Hayward as its immediate priorities. Other priority investments are "state of good repair" maintenance needs and station modernization. The *BART Vision Update* also identifies expansion as an investment priority and describes potential new corridors and infill stations to increase capacity (BART 2014).

1.3.15 San Jose International Airport Master Plan

SJC is one of the three primary airports that serve the San Francisco Bay Area. The airport is classified as a medium hub airport by the Federal Aviation Administration and ranked as the 44th busiest airport in terms of total passengers in 2013 (City of San Jose 2015b). SJC is owned and

[10] The proposed North Lathrop Station is a component of the ACE Extension Project.

[11] The Northern California Megaregion is composed of 21 counties grouped into four regions: Bay Area, Sacramento Area, Northern San Joaquin Valley, and Monterey Bay Area.

operated by the City of San Jose on 1,050 acres at the southern end of San Francisco Bay. The airport is generally bounded by US 101 on the north, the Guadalupe River and SR 87 on the east, I-880 on the south, and Coleman Avenue and De la Cruz Boulevard on the west. The *Airport Master Plan for Norman Y. Mineta San Jose International Airport* (Airport Master Plan) (City of San Jose Airport Department 2011) was approved in 1997 and updated in 2011. It identifies a range of improvements to airside and landside facilities to accommodate the forecasted 2027 air passenger, air cargo, and general aviation demand. Passenger demand fluctuated between 2006 and 2012, largely because of the nationwide recession and associated airline capacity cuts. During this period, the Airport Master Plan was revised to more closely align project implementation to air passenger and facility demands (City of San Jose Airport Department 2011). The airport served 9.1 million passengers in 2014, a 6.8 percent increase from 2013 passenger volumes (City of San Jose 2015b).

Ground transportation services at the airport include shuttles, taxis, rental cars, and limousines/ charters. VTA Route #10 (the VTA Airport Flyer) provides connections from the airport to BART, VTA light rail, Caltrain, Amtrak, and ACE rail services. A new transit link to the airport from the VTA's Guadalupe light rail transit line, and from Caltrain and future BART in Santa Clara, using automated people mover technology is part of the VTP 2040 (VTA 2014a) capital investment program. Implementing the project would provide HSR service at Diridon Station, which is close to the airport and offers a connection point for HSR and air travelers, increasing modal connectivity at this airport.

1.3.16 Oakland International Airport

Built in 1927, OAK is one of the three primary airports that serve the Bay Area's shipping and passenger travel needs. It is owned and operated by the Port of Oakland and is located on the east side of the San Francisco Bay and south of Oakland in Alameda County. The *Oakland International Master Plan* was prepared between June 2004 and December 2005 and finalized in March 2006 (Port of Oakland 2006). It forecasts future aviation activity and presents potential development areas. The airport served 13 million passengers in 2017, a 26 percent increase from 2010 passenger volumes (Caltrans 2018). The master plan forecasts an increase to 30 million annual passengers by 2025.

Ground transportation services at the airport include shuttles, taxis, rental cars, and limousines/ charters. Line 73 of AC Transit connects OAK with the Coliseum/Oakland Airport BART station. From there, passengers can travel to Oakland, downtown San Francisco, Berkeley, and other major cities in the Bay Area. Amtrak is also available from this station.

1.4 Relationship to Other Transportation Projects in the Study Area

The objectives of the proposed HSR system include providing an interface with major commercial airports, mass transit, and the highway network. Other key transportation projects in the project vicinity that offer intercity travel benefits and could enhance intermodal connections to the proposed HSR system are described in this section. These projects have been considered in the planning and development of the Project Section and station location alternatives.

1.4.1 Caltrain Modernization Program

The Caltrain Modernization Program will electrify and upgrade the performance, operating efficiency, capacity, safety, and reliability of Caltrain's commuter rail service through the delivery of several key projects. These include the electrification of the existing Caltrain corridor from San Francisco to San Jose; the installation of a Communications Based Overlay Signal System Positive Train Control, which is an advanced signal system that includes federally mandated safety improvements; upgrades to the signal system; and the replacement of Caltrain's diesel trains with high-performance electric trains or Electric Multiple Units (Caltrain 2018). The environmental process on the PCEP (electrification and new electric trains) was completed in January 2015. Upgrades to the signal system have been completed and are now undergoing testing. The next steps involve community engagement and education and setting up project teams. The Caltrain electrification is scheduled to be completed in 2022 (Caltrain 2018).

1.4.2 Caltrain South Terminal Phases II and III

Phase II of Caltrain's proposed South Terminal Project, construction of which is anticipated to occur between 2018 and 2020, would make track improvements along the existing right-of-way from San Jose Diridon Station to the Centralized Equipment Maintenance and Operation Facility (CEMOF) located north of the station, along Stockton Avenue in San Jose. The project involves installing a fourth track and signal controls between the station's north end and the maintenance facility. The proposed fourth track would extend approximately 2,000 feet from CEMOF to the northern end of the San Jose Diridon Station, on the east side of the existing tracks (Caltrain 2016). Caltrain's proposed improvements and the ability to move trains to and from the maintenance facility without interrupting passenger service will help maintain flexibility, minimize delays, and improve operations at CEMOF and the San Jose Diridon Station (Caltrain 2016).

South Terminal Phase III will replace the railroad bridge crossing at Los Gatos Creek in San Jose to address the bridge's failure to meet seismic safety standards. The project will also include installation of a tail track south of Diridon Station. The tail track will provide improved operations at the station, minimize systemwide delays, and facilitate Caltrain modernization, including electrification of the corridor (Caltrain 2014b).

1.4.3 Bay Area Rapid Transit Silicon Valley Extension

The BART Silicon Valley Extension involves various transportation improvements in the Silicon Valley Rapid Transit Corridor. This corridor extends from the southern boundary of Alameda County in Fremont through Milpitas, San Jose, and Santa Clara. The planned improvements include a 16-mile, six-station extension of the existing BART system into Silicon Valley (VTA 2018a). The BART Silicon Valley program also includes other related projects and activities required to prepare the rail corridor for BART, such as relocation of existing UPRR tracks and utilities, drainage improvements, and grade separation projects within the alignment that are funded through other sources. BART Silicon Valley is being managed by the VTA in cooperation with BART. BART Silicon Valley will be constructed in phases. Phase I is complete; the Berryessa Extension, extending 10 miles from the Warm Springs Station in Fremont created two new stations: (1) Milpitas Station at the intersection of Montague Expressway and Capitol Avenue, and (2) Berryessa Station between Berryessa and Mabury roads adjacent to the San Jose Flea Market (VTA 2018b, 2018c, 2018d; BART 2020). Phase II will extend BART from the Berryessa Extension for approximately 6 miles, ending at-grade in Santa Clara adjacent to the Santa Clara Caltrain Station and Santa Clara University, with three additional stations with below-ground concourses and boarding platforms. One of the three additional stations would be the San Jose Diridon Station, where passengers would be able to connect to HSR.

1.4.4 Silicon Valley Express Lanes

The VTA Silicon Valley Express Lanes program is expanding the network of express lanes used by carpoolers, motorcyclists, and clean-air vehicles for free, as well as single-occupant vehicles that pay a toll with a FasTrak transponder. The program would be implemented over four phases across the SR 237 and SR 85/US 101 freeways. Operation of Phases 1 and 2 of Santa Clara County's first express lanes on the SR 237/I-880 corridor began in March 2012 (VTA 2018e). Phase 3 is currently under construction, while Phase 4 is in the Design and Engineering stage (VTA 2020a, 2020b). Phase 5 is pending funding but anticipated to be built between 2023 and 2025 (VTA 2020c).

1.4.5 ACE Extension Lathrop to Ceres/Merced

ACE Extension is a phased improvement plan proposed by the SJRRC to enhance intercity service and transit connectivity in the Central Valley; reduce traffic congestion, improve regional air quality, and reduce GHG emissions; and promote local and regional land use and transportation sustainability goals. The ACE Extension would extend ACE service to Ceres and

Merced. Specifically, SJRRC plans to extend ACE service to Manteca, Ripon, Modesto, Ceres, Turlock, Livingston, Atwater, and Merced.[13]

1.4.6 Valley Link

ACE Extension is a phased improvement plan proposed by the Tri-Valley–San Joaquin Valley Regional Rail Authority to enhance rail connection between BART and ACE in the tri-valley. Valley Link would establish rail service in the tri-valley and would include the following stations between the Dublin Pleasanton BART and the proposed North Lathrop Station: Isabel Station, Greenville ACE Intermodal Station, Mountain House Station, Downtown Tracy Station, and River Islands Station. Three additional stations are currently being considered: South Front Station, Grant Line Road Station, and Ellis Station (Tri-Valley San Joaquin Valley Regional Rail Authority 2020a). The Tri-Valley San Joaquin Valley Regional Rail Authority released a Draft EIR for the Valley Link project for public review and comment on December 2, 2020 (Tri-Valley San Joaquin Valley Regional Rail Authority 2020b).

1.4.7 San Jose International Airport Automated People Mover Connector

The Automated People Mover project will provide a dedicated guideway connection from the Airport to the Caltrain, Bus Rapid Transit (BRT), and future BART stations at the Santa Clara Transit Center and to the VTA light rail station on North First Street (City of San Jose 2018).

1.4.8 Bus Rapid Transit

In accordance with VTA's *Bus Rapid Transit Strategic Plan*, the agency has initiated BRT projects for Alum Rock Avenue and Stevens Creek Boulevard corridors (VTA 2009). A brief description of these projects follows:

- The Alum Rock–Santa Clara BRT Project provides 7 miles of limited-stop rapid transit service between the Eastridge Transit Center to the Arena Station in downtown San Jose using Capitol Expressway, Alum Rock Avenue, and Santa Clara Street. Construction was completed in May 2017.
- The Stevens Creek BRT Project would provide a rapid transit service for 8.5 miles from DeAnza College to the Transit Mall in downtown San Jose using San Carlos Avenue and Stevens Creek Boulevard. The Stevens Creek project would add BRT service in addition to the local service, which would provide fast, frequent service with limited stops and enhanced amenities for passengers (VTA 2014b). Based on ridership demand along the Stevens Creek corridor, VTA implemented Rapid 523 bus service in 2019 as a near-term improvement and early deliverable of the Stevens Creek BRT Project. It will provide a connection from the Berryessa BART Station to West San Carlos/Stevens Creek via downtown San Jose, providing fast, frequent, and reliable service to Santa Clara and Cupertino. It will increase service frequency, improve passenger waiting areas, and speed up the service with coordinated traffic signals (VTA 2018f).

1.4.9 Double-Track Segments of the Caltrain Line between San Jose and Gilroy

Approximately 8 miles of double tracking on the existing UPRR corridor between San Jose and Gilroy is planned to increase Caltrain capacity with an estimated completion year of 2022 (VTA 2018g). Caltrain will continue to operate six daily diesel trains serving the Gilroy Extension (three northbound trains during the AM peak and three southbound trains during the PM peak) (Caltrain 2015); double-track segments may result in fewer conflicts with UPRR operations.

1.4.10 Monterey County Rail Extension

Previously called the Capitol Corridor Extension to Salinas, the Monterey County Rail Extension will extend passenger rail service from Santa Clara County south to Salinas, approximately 68

[13] New stations would be implemented in North Lathrop and along the extension alignment in Downtown Manteca, Ripon, Modesto, and Ceres (San Joaquin Regional Rail Commission 2018).

miles. Three phases are proposed, starting with the Kick Start Phase and followed by two phases for construction of the Pajaro/Watsonville Multimodal Transit Hub (a connection point for Santa Cruz County) and the Castroville Multimodal Station (a connection point for Monterey Peninsula). Implementation of the Kick Start Phase started in 2018, and the first step of three (Salinas Station: Lincoln Avenue Extension, circulation, and parking improvements) is nearly completed. This phase involves improvements to the existing Salinas train station, construction of a new train layover facility, and track improvements in Gilroy (TAMC 2018, 2020).

2 ALTERNATIVES

Since publication of the Draft Environmental Impact Report (EIR)/Environmental Impact Statement (EIS), the following substantive changes have been made to this chapter:

- In Section 2.1, Introduction, the electronic format of the Final EIR/EIS available from the California High-Speed Rail Authority (Authority) was clarified, and a footnote was added noting that repositories that received the Final EIR/EIS for public review may have reduced open days/hours to comply with coronavirus public health and safety directives.
- Information to clarify lighting and glare associated with high-speed rail (HSR) system infrastructure was added throughout Section 2.4, HSR System Infrastructure.
- Section 2.5, Alternatives Considered during Alternatives Screening Process, was revised to include discussion of vertical alternatives considered for the San Joaquin Valley Subsection.
- A footnote was added to Section 2.6.1, No Project Alternative—Planned Improvements, regarding the updated Council on Environmental Quality (CEQ) regulations issued after release of the Draft EIR/EIS.
- Section 2.6.1.2, Planned Land Use, was updated to remove references to the baseball stadium, outdoor performing arts pavilion, and proposed underground parking garage; to reflect that the Google campus is 85 acres within the 250-acre Diridon Station Area Plan area; to reflect that the Stockton Avenue seven-story development is under construction and nearly completed; and to reflect that a multifamily (not single-family) residential project is moving forward on Communications Hill adjacent to the proposed project alignment.
- Park Avenue, St. John Street, and Autumn Street widening projects were removed from Table 2-5, as they were constructed in 2018.
- Section 2.6.1.4, Planned Aviation Improvements, was revised to reflect the current name of the airport and the planned projects included in the *Airports Business Plan* (County of Santa Clara 2018).
- Section 2.6.1.5, Planned Intercity Transit Improvements, was updated with information about Caltrain, specifically the Peninsula Corridor Joint Powers Board (PCJPB) and its agreements.
- Analysis about the Diridon design variant (DDV) and tunnel design variant (TDV), which was included in Section 3.20 in the Draft EIR/EIS, was incorporated into Section 2.6.2, San Jose to Central Valley Wye Project Alternatives, including figures illustrating the extents of the TDV and DDV (Figures 2-56 and 2-67, respectively).
- Section 2.6.2.4, Alternative 1, was updated to clarify replacement parking locations and state highway and local road modifications.
- Section 2.6.2.7, Alternative 4, was updated to clarify replacement parking locations, to add reference to Tunnel 2 in the Pacheco Pass Subsection section, and to update Figure 2-66 to show the Diridon Station design to match the preliminary engineering drawings in Volume 3.
- Section 2.7.1, Travel Demand and Ridership Forecasts, was updated to reference ridership forecasts for 2040 in the 2020 Business Plan (Authority 2021).
- Section 2.7.4, Ridership and Station Parking, was updated to clarify that no new parking is proposed at the San Jose Diridon Station to meet new HSR parking demand and that new parking demand would be met through existing public and private parking taking into consideration reduced demand overall due to planned Caltrain and BART transit service to the Diridon Station.
- A footnote was added to Table 2-14 to clarify that no revenue trains would operate between midnight and 6am.
- A footnote to Table 2-15 was clarified as referring to Skyway Drive design variants.

- Table 2-17 was revised to reflect the correct jurisdiction for the staging area east of Lafayette Street, the location for two 1.7-acre, one 2.3-acre, and one 1.8-acre sites was corrected to Blossom Hill Road, and references to Church Avenue were corrected to Church Street.
- Text has been added in Section 2.10, Construction Plan, to indicate that no construction within the Grasslands Ecological Area would occur at night.
- A footnote was added to Section 2.6.2.2, Summary of Design Features, to reflect that the 2020 Business Plan refined the Valley-to-Valley service operational date from 2029 to 2031.
- Text has been added to Section 2.11, Permits, to clarify that local permits may include but are not limited to major encroachment permits, grading and drainage permits, and major improvement permits.
- In Table 2-18, the U.S. Department of the Interior, Bureau of Reclamation's agency name was corrected. West Branch Llagas Creek (Alternatives 1, 2, and 4) was added to Table 2-18, and the permits required by the California Department of Transportation were updated.
- A new Appendix 2-M, Gilroy LMF Option Consideration and Elimination, was added to provide a history of planning for the Light Maintenance Facility (LMF) and the reasons for eliminating a Gilroy LMF from consideration.

2.1 Introduction

This chapter describes the four end-to-end alternatives and the No Project Alternative that the Authority is considering in this Final EIR/EIS. The chapter addresses the following topics:

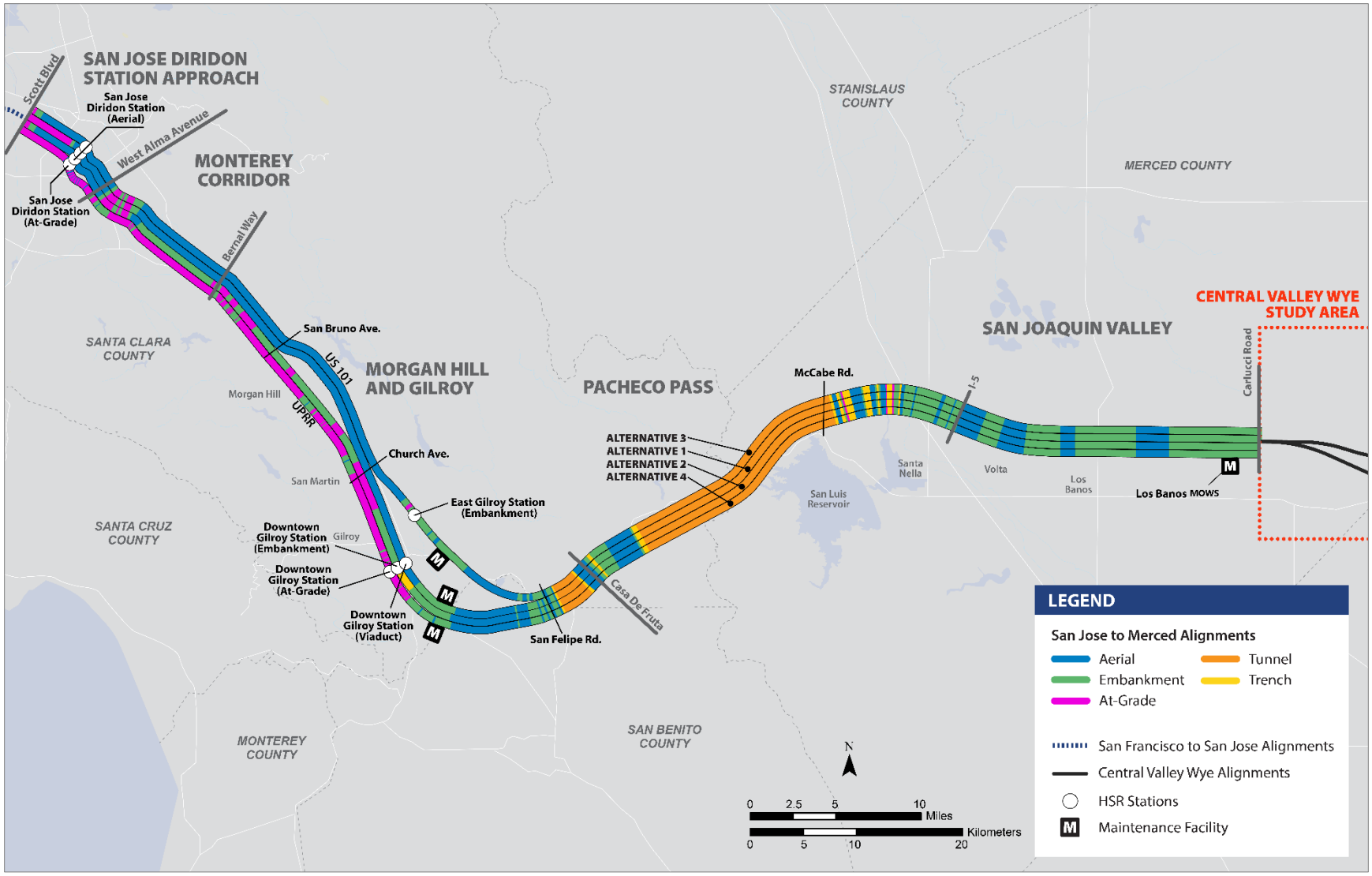
- The background and development of the California HSR System and the San Jose to Merced Project Section (Project Section)
- A general description of HSR system infrastructure
- Potential alternatives considered during the alternatives screening process and not carried forward for full evaluation in this Final EIR/EIS
- The No Action (No Project) Alternative and the San Jose to Central Valley Wye Project Extent (project) alternatives
- Travel demand and ridership forecasts
- Operations and service plan
- Construction plan
- Permits and approvals required

More detailed information on characteristics of the project is provided in the following appendices:

- Appendix 2-A, Roadway Crossings, Modifications, and Closures
- Appendix 2-B, Railroad Crossings
- Appendix 2-C, Operations and Service Plan Summary
- Appendix 2-D, Applicable Design Standards
- Appendix 2-E, Project Impact Avoidance and Minimization Features
- Appendix 2-F, PG&E Network Upgrades
- Appendix 2-G, Maintenance Plan or Summary of Requirements for Operations and Maintenance Facilities
- Appendix 2-H, Emergency and Safety Plans
- Appendix 2-I, Interim Use/Phased Implementation

- Appendix 2-J, Regional and Local Plans and Policies
- Appendix 2-K, Policy Consistency Analysis
- Appendix 2-L, Constructability Report

The four project alternatives discussed in this chapter are consistent with and build from the train technology, alignment corridor, and station locations selected by the Authority and the Federal Railroad Administration (FRA) at the conclusion of the Tier 1 EIR/EIS processes for the HSR system (see Section 1.1.2, The Decision to Develop a Statewide High-Speed Rail System). The four alternatives are the result of the Authority's consideration of an extensive array of potential alternatives and sub-alternatives, all with the benefit of extensive public, stakeholder, and agency input. The design drawings that support the descriptions of the alternatives are provided in Volume 3, Preliminary Engineering for Project Design Record, of this Final EIR/EIS. Figure 2-1 illustrates the alternatives considered in this Final EIR/EIS. These alternatives are designed to a preliminary level of engineering sufficient to identify and analyze potential environmental impacts. Alternative 4 is the California Environmental Quality Act (CEQA)-proposed project pursuant to CEQA Guidelines Section 15124.



Source: Authority 2019a

JANUARY 2019

Figure 2-1 HSR Alternatives with Vertical Profile

This Final EIR/EIS analyzes the environmental impacts—direct, indirect, and cumulative—of implementing the San Jose to Central Valley Wye Project Extent (see definition in sidebar) of the HSR system, and mitigation measures to reduce those impacts. Visit the Authority website (www.hsr.ca.gov) to access the Final EIR/EIS, request an electronic copy of the Final EIR/EIS, or locate a library to review a printed copy of the Final EIR/EIS. Printed copies of the Final EIR/EIS have been placed in public libraries in the following cities and communities: Sacramento, San Jose, Morgan Hill, Gilroy, Los Banos, and Merced.[1]

The following documents can be accessed via the Authority's website: alternatives analyses preceding preparation of the EIR/EIS, materials prepared for coordination with the U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (USEPA) in compliance with Clean Water Act (CWA) Section 404(b)(1) requirements, and technical reports developed for the environmental analyses presented in Chapter 3.

The Project Section comprises three extents: (1) from Scott Boulevard in Santa Clara to Carlucci Road in Merced County, the western terminus of the Central Valley Wye (i.e., the San Jose to Central Valley Wye Project Extent [project extent, or project]; (2) the Central Valley Wye, which connects the east-west portion of HSR from the San Francisco Bay Area (Bay Area) to the Central Valley with the north-south portion from Merced to Fresno; and (3) the northernmost portion of the Merced to Fresno Project Section, from the northern limit of the Central Valley Wye (Ranch Road) to the Merced Station (Figure 2-2).

The following terms are defined as follows for purposes of this report:

- **Project Section:** This signifies the San Jose to Merced project with the station termini.
- **Project extents:** *Project extent* is used to refer to the three portions of the Project Section—San Jose to Central Valley Wye (Scott Boulevard to Carlucci Road), Central Valley Wye (Carlucci Road to Ranch Road in the north and Avenue 19 in the south), and Merced North (Ranch Road in the south to the Merced Station)—that collectively form the project section connecting San Jose and Merced.
- **Project subsections:** *Project subsections* are the constituent parts of a given project section or project extent. The San Jose to Central Valley Wye project extent consists of five subsections: San Jose Diridon Station Approach, Monterey Corridor, Morgan Hill and Gilroy, Pacheco Pass, and San Joaquin Valley.
- **Design options**: *Design options* are the different alignment and vertical profile options considered within each subsection.
- **Alternative**: *Alternatives* are the end-to-end alternatives assembled from design options under consideration in the Final EIR/EIS.

Because the portion of the Project Section between Merced and Carlucci Road has been analyzed in the *Final California High-Speed Train Project Environmental Impact Report/Environmental Impact Statement and Final Section 4(f) Statement and Draft General Conformity Determination—Merced to Fresno Section* (Merced to Fresno Section Final EIR/EIS) (Authority and FRA 2012) and the *Merced to Fresno Section: Central Valley Wye Final Supplemental EIR/EIS* (Authority 2020a), the analysis in this document focuses on the project extent between Scott Boulevard in Santa Clara and Carlucci Road in Merced County (the project). While the northern service limit of the project would be the San Jose Diridon Station, the engineering design and evaluation includes infrastructure and train operations north to Scott Boulevard to serve the San Jose Diridon Station.

The project extent is a 90-mile portion of the entire 145-mile-long San Jose to Merced Project Section. For three of the four project alternatives, the project is comprised of a blended system[2] north of the San Jose Diridon Station, transitioning to a fully dedicated system from the San Jose Diridon Station south to Gilroy, then proceeding east through the Pacheco Pass to Carlucci Road, the western limit of the Central Valley Wye. Alternative 4 is a blended system to the Downtown Gilroy Station, where it transitions to a dedicated system. The project comprises five subsections (Table 2-1).

[1] The COVID-19 pandemic has resulted in widespread closure of government and public facilities, including local libraries the Authority identified as repositories where the public would have the opportunity to review the Draft EIR/EIS, Revised Draft EIR/Supplemental Draft EIS, and Final EIR/EIS. These facilities received the Final EIR/EIS for public review; however, open days/hours may be reduced for compliance with coronavirus public health and safety directives.

[2] The California HSR System will operate with regional and local train (Caltrain) operations primarily on shared tracks and substantially within the existing Caltrain corridor (blended system).

Source: Authority 2019a JUNE 2019

Figure 2-2 San Jose to Merced Project Section Geographic Context

Table 2-1 San Jose to Central Valley Wye Project Extent Subsections

Subsection	Start	End
San Jose Diridon Station Approach (overlaps southern portion of San Francisco to San Jose Project Section)	Scott Boulevard (city of Santa Clara)	West Alma Avenue (city of San Jose)
Monterey Corridor	West Alma Avenue (city of San Jose)	Bernal Way/Kittery Court (community of South San Jose, city of San Jose)
Morgan Hill and Gilroy (includes Gilroy Station)	Bernal Way (community of South San Jose, City of San Jose)	Casa de Fruta Parkway (community of Casa de Fruta, Santa Clara County)
Pacheco Pass	Casa de Fruta Parkway (community of Casa de Fruta, Santa Clara County)	Interstate 5/Santa Nella Boulevard (community of Santa Nella, Merced County)
San Joaquin Valley	Interstate 5/Santa Nella Boulevard (community of Santa Nella, Merced County)	Carlucci Road (unincorporated Merced County)

Source: Authority 2019a

Portions of the Project Section with blended Caltrain and HSR operations will be implemented on Caltrain-owned facilities including from north of the Santa Clara Station to Scott Boulevard under Alternative 1 and from north of Capitol Station to Scott Boulevard under Alternative 4. The alternative descriptions have been developed based on planning assumptions and preliminary engineering

conducted by the Authority for the purposes of environmental analysis and the ultimate implementation of the project (both physical and operation of services) on Caltrain-owned facilities will be subject to further joint Blended System planning and agreement with Caltrain as governed through existing and future inter-agency agreements. The ongoing multi-agency Diridon Integrated Station Concept (DISC) planning process is a separate planning process and decisions about future changes to the Diridon station and the surrounding, Caltrain-owned rail infrastructure and corridor are the subject of multiple planning and agreement processes that are proceeding independently from this environmental process.

2.2 Independent Utility

As discussed in Chapter 1, Project Purpose, Need, and Objectives, the Authority and FRA divided the HSR system originally established through the Tier 1 process into individual project sections for Tier 2 planning, environmental review, and decision-making (Figure 1-2). The FRA, consistent with regulations issued by the Federal Highway Administration (FHWA), considers three criteria when determining the scope of a project to be considered in an EIS: (1) whether it connects "logical termini" and has "sufficient length to address environmental matters on a broad scope"; (2) whether it has "independent utility or independent significance," meaning that it will "be usable and be a reasonable expenditure even if no additional transportation improvements in the area are made"; and (3) whether it will "restrict consideration of alternatives for other reasonably foreseeable transportation improvements" (23 Code of Federal Regulations [C.F.R.] 771.111(f)). The FHWA defines *logical termini* as the rational starting and ending points for a transportation improvement project and for review of the environmental impacts of the project (FHWA 1993).[3] The San Jose to Merced Project Section connects logical termini at planned passenger stations in Merced and San Jose, with a connection to a station in Fresno via the Central Valley Wye. If other sections of the HSR system are not completed, the infrastructure could be used by regional and intercity services to improve their capacity, reliability, and performance (Authority 2009).

2.3 Background

This Project Section would be a critical link in the Phase 1 HSR system connecting San Francisco and the Bay Area to Los Angeles and Anaheim. The Authority relied on program EIR/EIS documents (see Section 1.1.2) to select the alternatives for further study between San Jose and Merced. The project-level environmental review process and alternatives considered in this document are consistent with the decisions made during the Tier 1 review process and are discussed further in Section 2.5, Alternatives Considered during Alternatives Screening Process.

2.4 HSR System Infrastructure

This section provides general information about the performance criteria, infrastructure components and systems, and function of the proposed HSR system as a whole. Detailed information on the project alternatives, including alignment, station locations, and locations for maintenance facilities, is provided in Section 2.6, Alignments, Station Sites, and Maintenance Facilities Evaluated in this Final EIR/EIS.

The project's alignment, design options, and operational facilities, such as traction power distribution facilities and maintenance facilities, are presented in this Final EIR/EIS geographically from Scott Boulevard in Santa Clara to Carlucci Road in Merced County. The Preliminary Engineering for Project Definition design drawings—showing track alignments, vertical profiles, typical sections, construction use areas, and other preliminary design information—are provided in Volume 3 of this Final EIR/EIS, which can be accessed on the Authority's website (www.hsr.ca.gov) or by request in electronic format.

[3] The FHWA criteria for determining project scope, as established in 23 C.F.R. Section 771.111(f), do not specifically address the scope of individual projects considered in the second tier of a tiered NEPA process. With the tiered NEPA process, the same general principles apply, but they are applied in the context of the decisions made in Tier 1—in this case, the decision to build the HSR system as a whole. Therefore, in determining the scope of individual project sections for Tier 2 studies, the Authority and FRA focused primarily on determining whether each project section could serve a useful transportation purpose on its own such that a decision in one project section does not limit consideration of reasonable alternatives for completing the HSR system in an adjacent section for which the NEPA process has not yet been completed.

What does "blended" mean?

Blended refers to operating HSR trains with existing intercity, commuter, and regional trains on shared infrastructure.

The infrastructure and systems of the HSR system consist of HSR trains, tracks, stations, automatic train control (ATC) and communication sites, overhead contact system (OCS) (a series of wires strung above the tracks) and traction power distribution systems, and infrastructure and vehicle maintenance facilities. The design of each HSR alternative includes a double-track rail system to accommodate operational needs for high-capacity rail movement. Additionally, the HSR safety criteria require avoidance of at-grade intersections on dedicated HSR alignments; accordingly, the system must be grade-separated from any other transportation system when operating at or above 125 miles per hour (mph). This criterion means that the HSR system would require grade-separated overcrossings or undercrossings for roadways that intersect the planned right-of-way; roadway closures and modifications to such facilities may be necessary. In some situations, it may be more efficient for the HSR guideway to be elevated over existing facilities. The HSR safety criteria allow at-grade intersections on blended sections such as those proposed under Alternative 4, in the San Francisco to San Jose Project Section, where HSR would operate alongside Caltrain, and in the Los Angeles to Anaheim Project Section, where HSR would operate alongside Metrolink.

2.4.1 System Design Performance, Safety, and Security

The proposed HSR system is designed for optimal performance in conformance with industry standards and federal and state safety regulations (Table 2-2). The HSR right-of-way would be fully grade-separated and access-controlled with intrusion detection and monitoring systems. In areas where HSR would operate at speeds of 125 mph or more and would be adjacent to existing freight railroads, intrusion protection barriers may be required to prevent encroachment into the HSR guideway. Where blended operations are necessary or otherwise identified, speeds would be limited to less than 125 mph, at-grade roadway crossings would be controlled by four-quadrant gates and roadway channelization, and unauthorized access would be deterred using intrusion detection and monitoring systems.[4]

Table 2-2 HSR Performance Criteria

Category	Criteria
System design criteria	▪ Electric propulsion system ▪ Fully grade-separated guideway (except in the blended system) ▪ Fully access-controlled guideway with intrusion monitoring systems ▪ Track geometry to maintain passenger comfort criteria (smoothness of ride, lateral or vertical acceleration less than 0.1 g [i.e., acceleration due to gravity])
System capabilities	▪ Capable of traveling from San Francisco to Los Angeles in approximately 2 hours 40 minutes ▪ All-weather/all-season operation ▪ Capable of sustained vertical gradient of 2.5 percent without considerable degradation in performance ▪ Capable of operating parcel and special freight service as a secondary use ▪ Capable of safe, comfortable, and efficient operation at speeds greater than 200 mph ▪ Capable of maintaining operations at 3-minute headways ▪ Equipped with high-capacity and redundant communications systems capable of supporting fully automatic train control

[4] The Project Section design criteria dictate 250-mph design speeds on dedicated guideway sections to allow trains to operate at up to 220 mph where necessary to meet overall travel time specifications. The Authority is designing the San Joaquin Valley and Pacheco Pass Subsections to allow this operating speed, but tunnels in the Morgan Hill/Gilroy Subsection and the Pacheco Pass Subsection have been designed to a 200-mph operating speed, with a design variant identified that would allow for 220-mph operating speeds. Between Gilroy and San Jose, the design speeds would be less than the maximum design speeds as necessitated by practical design requirements in a heavily built environment. Where HSR would operate in blended service with Caltrain, HSR would operate at a maximum speed of 110 mph.

Category	Criteria
System capacity	▪ Fully dual track mainline with dedicated station tracks ▪ Capable of accommodating a wide range of passenger demand (up to 20,000 passengers per hour per direction) ▪ Capable of accommodating normal maintenance activities without disruption to daily operations
Level of service	▪ Capable of accommodating a wide range of service types (express, semi-express/limited stop, and local)

Source: Authority 2016a

HSR design and operations would include appropriate barriers (fences and walls) and state-of-the-art communication, access control, and monitoring and detection systems to keep people, animals, and obstructions off the tracks. The ends of the HSR trainsets would include a collision response management system to minimize the effects of a collision. All aspects of the HSR system would conform to the latest federal requirements regarding transportation security. The HSR trainsets (train cars) would be pressure-sealed to maintain passenger comfort regardless of aerodynamic change, much like an airplane body. Additional information regarding system safety and security is provided in Section 3.11, Safety and Security, of this Final EIR/EIS.

HSR operations would follow safety and security plans developed by the Authority in cooperation with FRA to include the following:

- A Safety and Security Management Plan (SSMP) (Authority 2016b), including a Safety and Security Certification Program, has been developed to address safety, security, and emergency response as they relate to the day-to-day operation of the system.
- A Threat and Vulnerability Assessment for security, a Preliminary Hazard Analysis, and a Vehicle Hazard Analysis generated comprehensive design criteria for safety and security requirements mandated by local, state, and federal regulations and industry best practices.
- A Fire and Life Safety and Security Program TM 500.4 (Authority 2012a) has been developed and a System Security Plan is in development. Under federal and state guidelines and criteria, the Fire Life Safety Plan would address the safety of passengers and employees as it relates to emergency response. The System Security Plan would address HSR design features intended to maintain security at stations, within the trackwork right-of-way, and onboard trains.

Design criteria address FRA safety standards and requirements as well as a possible Petition for Rule of Particular Applicability that addresses specifications for key design elements for the system. The FRA is currently developing safety requirements for HSR systems for use in the United States. The FRA will require that the HSR safety regulations be met prior to revenue service operations. The following sections describe those system components pertinent to the project.

2.4.2 Vehicles

Although the exact vehicle type has not yet been selected, the environmental analyses considered the impacts associated with any of the HSR vehicles produced in the world that meet the Authority's criteria. All the HSR systems in operation today use electric propulsion with power supplied by an OCS. These include, among many others, the Train à Grande Vitesse in France, the Shinkansen in Japan and Taiwan, and the InterCity Express in Germany. Figure 2-3 illustrates examples of typical HSR trains.

Source: Authority and FRA 2017a FEBRUARY 2017

Figure 2-3 Examples of Japanese Shinkansen High-Speed Trains

The Authority is considering an electric multiple-unit concept, in which several train cars (including both end cars) would contain traction motors, rather than a locomotive-hauled train (i.e., one engine in the front and one in the rear). Each train car would have an active suspension, and each powered car would have an independent regenerative braking system (which returns power to the power system). The body would be made of strong but lightweight materials and would have an aerodynamic shape to minimize air resistance, much like a curved airplane body.

A typical train would be 9 to 11 feet wide and approximately 660 feet long and would seat up to 1,000 passengers. The power would be distributed to each train car via the OCS through a pair of pantographs that extend like antennae above the train (Figure 2-4). Each trainset would have a train control system that could be independently monitored with override control, while also communicating with the systemwide Operations Control Center. Phase 1 HSR service is expected to need up to 78 trainsets in 2040, depending on the HSR fares charged and ridership levels (Authority and FRA 2017b). Vehicle lighting would comply with applicable rail safety, security, and operational requirements.

Source: Authority and FRA 2017a FEBRUARY 2017

Figure 2-4 Example of an At-Grade Profile Showing Overhead Contact System and Vertical Arms of the Pantograph Power Pickups

Trainset windows would be provided with tinted glazing. All windows in the passenger seating areas would be equipped with passenger-operated blinds or side curtains to provide protection against the glare of the sun. The trainset exterior, including front end and skirting, would be painted in accordance with the color schemes developed by the contractor and approved by the Authority. The exterior of the trainset would be coated with a gloss finish. The coating systems would be selected based on ability to withstand deterioration due to abrasion of particulates while operating at high speeds, ultraviolet light damage, and weather and the ability to be cleaned. For trainset exterior lighting, two white headlights (also known as headlamps), each producing a peak intensity of no less than 200,000 candelas, would be provided at the front end of each cab vehicle. Two white auxiliary lights, each producing a peak intensity of no less than 200,000 candelas, would be provided at the front end of each cab vehicle to form the points of a triangle with the headlights. The auxiliary lights would be arranged to burn steadily or flash. The flashing feature would be activated automatically but would also accommodate manual activation and deactivation by the operator.

2.4.3 Stations

Stations would be sized for projected HSR ridership and designed to provide flexibility to accommodate future growth. Station facilities include public and nonpublic areas, station site improvements to facilitate intermodal connectivity and station accessibility, and ancillary facilities. At existing stations modified for HSR service, public areas and station site improvements would be shared with other rail operators serving the station.

Station design has been developed at a concept level—Preliminary Engineering for Project Definition—for project-level environmental analysis and documentation, sufficient for disclosing the environmental impacts of building and operating a station. Figure 2-5 illustrates an example of station components from an existing overseas system and the Anaheim Regional Transportation Center in Anaheim.[5] The functional station is a basic design that could be more elaborate with cooperation from the local jurisdiction; accordingly, each actual station has the potential to be an iconic building that would enhance the identity of the city and the surrounding downtown environment in which it is located. Final station design would involve Authority collaboration with rail operators, local stakeholders, and land partners to complement transit-oriented and other station-supportive development.

Source: Authority and FRA 2017a

FEBRUARY 2017

Figure 2-5 Examples of Existing Stations

Preliminary station planning and design are based on Chapter 14, Stations, of the *Design Criteria Manual* (Authority 2016a) and principles from the Authority's *Draft HST Station Area Development: General Principles and Guidelines* (Authority 2011). The Project Section stations would be designed in accordance with Americans with Disabilities Act accessibility guidelines. The Project Section would

[5] The Anaheim Regional Transportation Center would serve as the HSR station in Anaheim.

include stations in San Jose, Gilroy, and Merced. The Merced Station was environmentally cleared in the Merced to Fresno Project Section EIR/EIS.

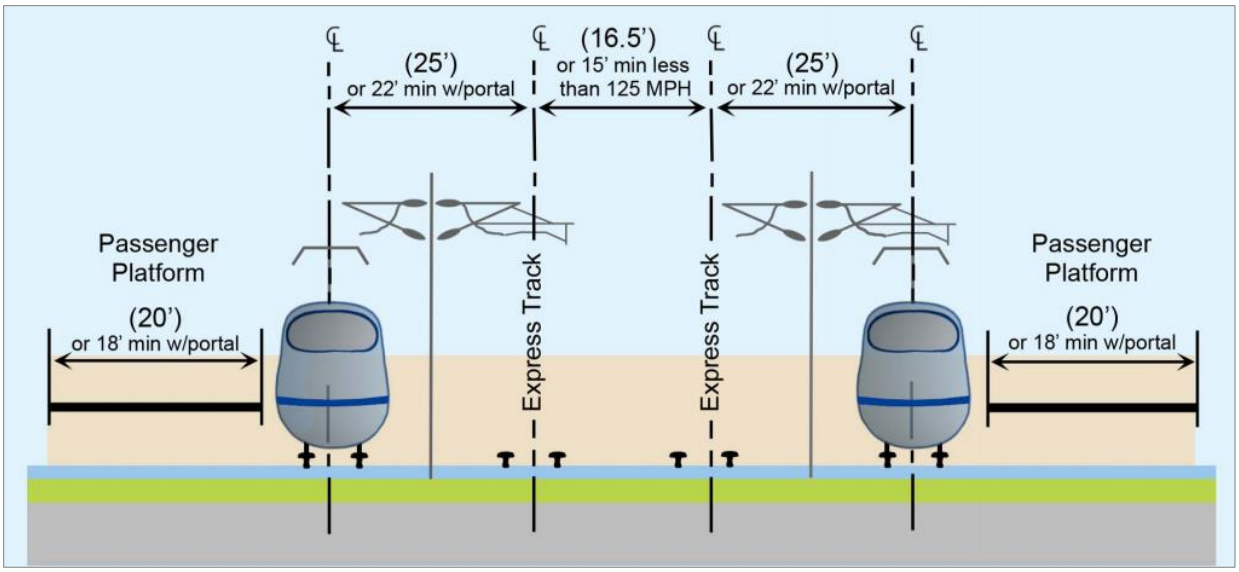
2.4.3.1 Station Platforms and Trackway (Station Box)

The station would provide a sheltered area and platforms for passenger waiting as well as circulation elements (stairs, elevators, escalators). Of the four tracks passing through the station, two express tracks (for trains that do not stop at the station) would be separated from those that stop at the station and platforms. To allow enough distance for safe deceleration of trains, the platform track would diverge from each mainline track 1,375 feet from the center of the station platform (the length of which may vary from 800 to 1,410 feet depending on the station). The acceleration track from platform to mainline requires a shorter distance. An additional stub-end 900-foot refuge track may be provided to temporarily store HSR trains in case of mechanical difficulty, for special scheduling purposes, and for daytime storage of maintenance-of-way work trains during periods when structure and track maintenance is being performed along the line near the station. The combination of deceleration, acceleration, and refuge track extends the wider footprint of the four-track section up to a total length of 2,750 feet. Figure 2-6 and Figure 2-7 illustrate cross sections of two- and four-train station platforms.

2.4.3.2 Station Facilities Building

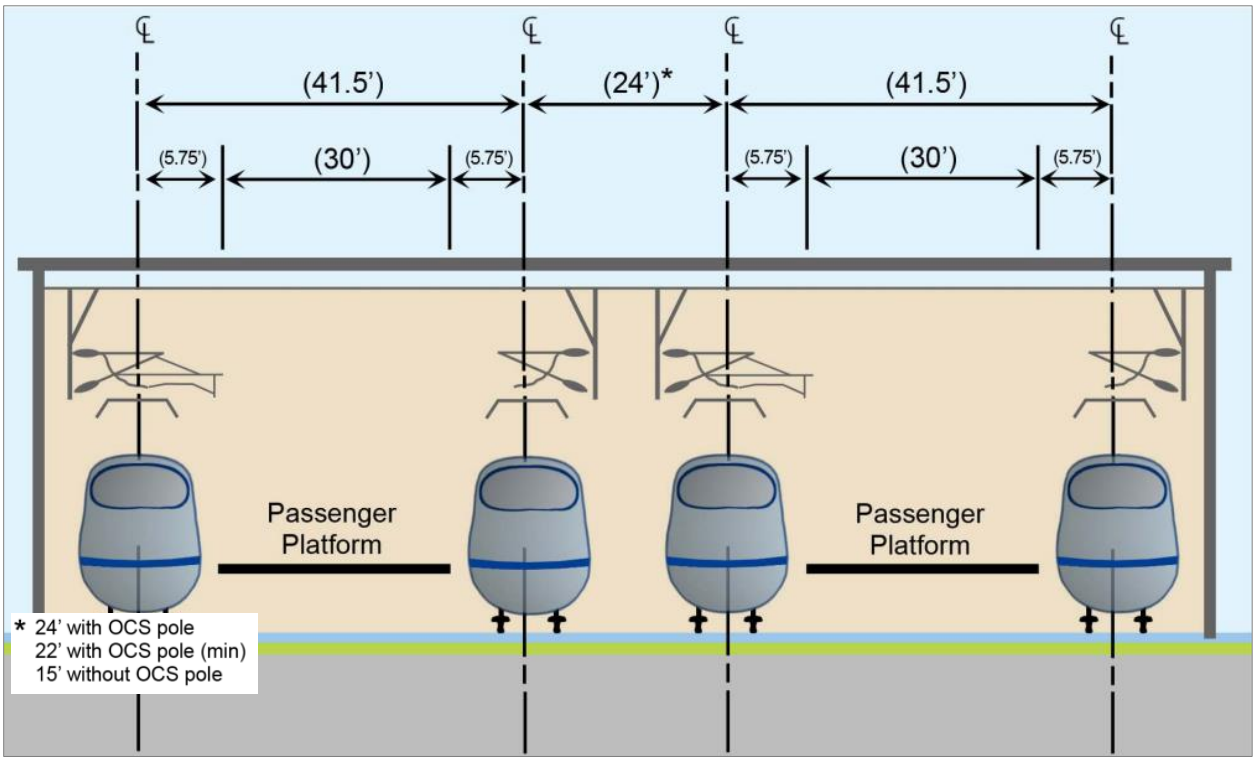
Station public areas include entry plazas and building entrances; ticketing; wayfinding/signage; publicly accessible restrooms; concessionaire-provided amenities such as food service, rental car counters, and retail; vertical circulation; concourse or mezzanine areas with passenger waiting areas; fare gates; controlled paid areas; and platforms. Pedestrian over-track bridges and under-track passageways enable public access across the rail right-of-way at stations. Station nonpublic areas include administrative, maintenance, operations, safety/security, loading, and back-of-house circulation areas. Stations and station sites, including parking facilities, roadways, and walkways, would have interior and exterior lighting. Fixed lighting sources at HSR stations would be designed to direct lighting downward, minimizing light spillover. Flood lighting of public HSR station facilities would generally be limited to hours of HSR operation at the station but may be required for maintenance during off-hours. Continuous lighting may be provided at emergency access and egress points and for security.

Station site improvements provide safe and efficient access for pedestrians, bicycles, transit, and vehicles to and from the station. Pick-up and drop-off zones offer direct and convenient access for taxis, ride hailing/sharing services, shuttles, transit, and private and commercial vehicles. Parking supply estimates are based on projected parking demand and local conditions. Station site plans are configured to support transit-oriented development (TOD). Ancillary facilities are unoccupied back-of-house spaces required for station operations and maintenance, including normal, back-up, and emergency power systems.



Source: Authority 2016a FEBRUARY 2017

Figure 2-6 Two-Train Station Platform Cross Section



Source: Authority 2016a FEBRUARY 2017

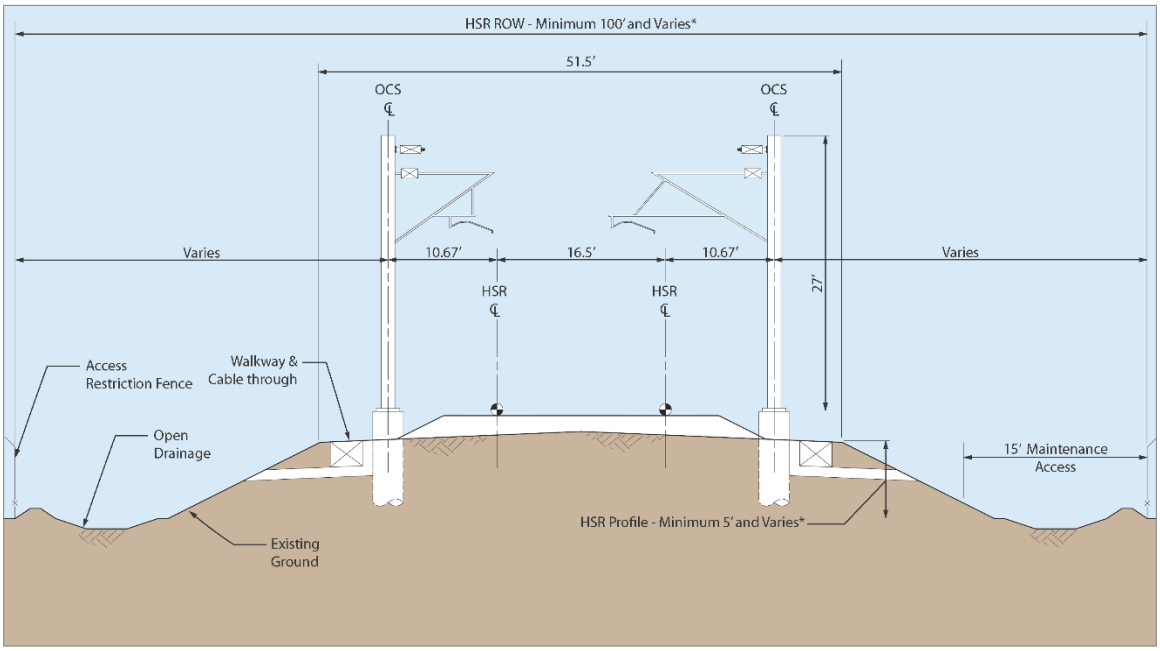
Figure 2-7 Four-Train Station Platform Cross Section

2.4.4 Infrastructure Components

The fully grade-separated, dedicated track infrastructure needed to operate HSR trains at speeds greater than 125 mph has more stringent alignment requirements than infrastructure for conventional trains. The project would use multiple track support types, or profiles: low, near-the-ground tracks would be at grade; higher tracks would be elevated on structure (viaduct) or on embankment; and below-grade tracks would be in open cut, retained cut, trench, or tunnel. Types of bridges that might be built include full channel spans, large box culverts, and, for wider river crossings, limited piers below the ordinary high-water mark of the established channel. Two tunnels would be constructed: one in the Morgan Hill to Gilroy Subsection and one in the Pacheco Pass Subsection. Flood lighting or night lighting would not be installed along the HSR guideway for track operations or maintenance, except for specific sited facilities such as maintenance and systems sites. Lighting would be used with closed-circuit televisions (CCTV). In spaces where lighting would be inappropriate due to environmental impacts, infrared receptors with infrared cameras or other appropriate technologies may be used. Temporary, portable lighting would be used at all locations when maintenance work is being undertaken to ensure sufficient light levels to undertake the work safely. The various track profiles are described below.

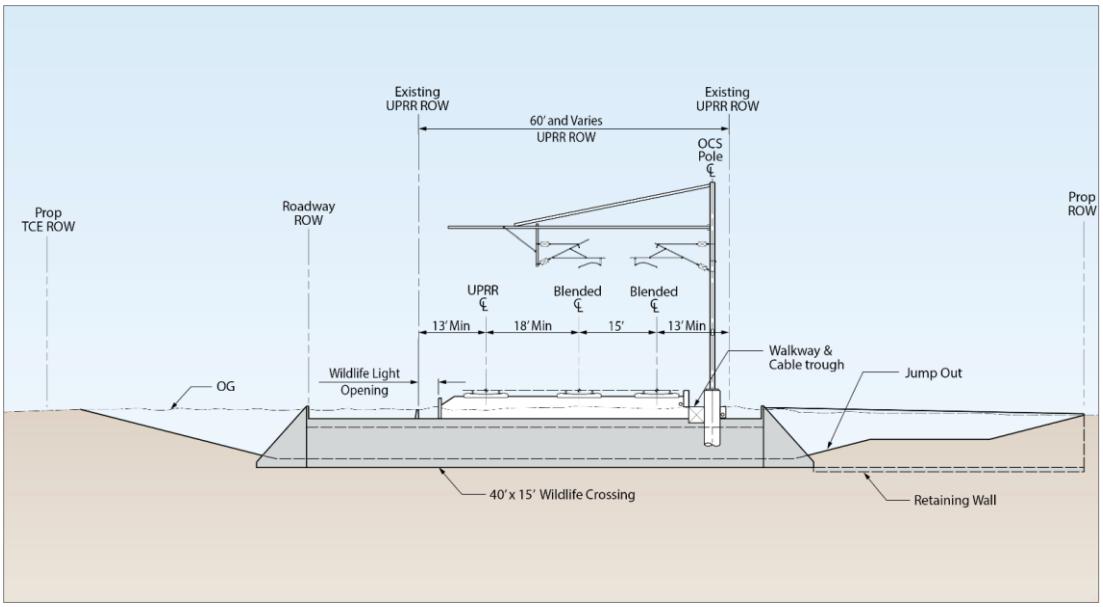
2.4.4.1 At-Grade Profile

An at-grade profile for both dedicated tracks and blended operations (Figure 2-8 and Figure 2-9) is best suited for areas where the ground is relatively flat, as in the Central Valley, and in rural areas where interference with local roadways is infrequent. The at-grade track would be built on compacted soil and ballast material (a thick bed of angular rock) to prevent subsidence or changes in the track surface from soil movement. To avoid potential disruption of service from floodwater, the rail would be constructed above the 100-year floodplain. The at-grade track profile would be 5 feet high to accommodate slight changes in topography, provide clearance for stormwater culverts and structures to allow water flow, and sometimes to provide safe crossings for wildlife movement.



DECEMBER 2017

Figure 2-8 Typical At-Grade Cross Section

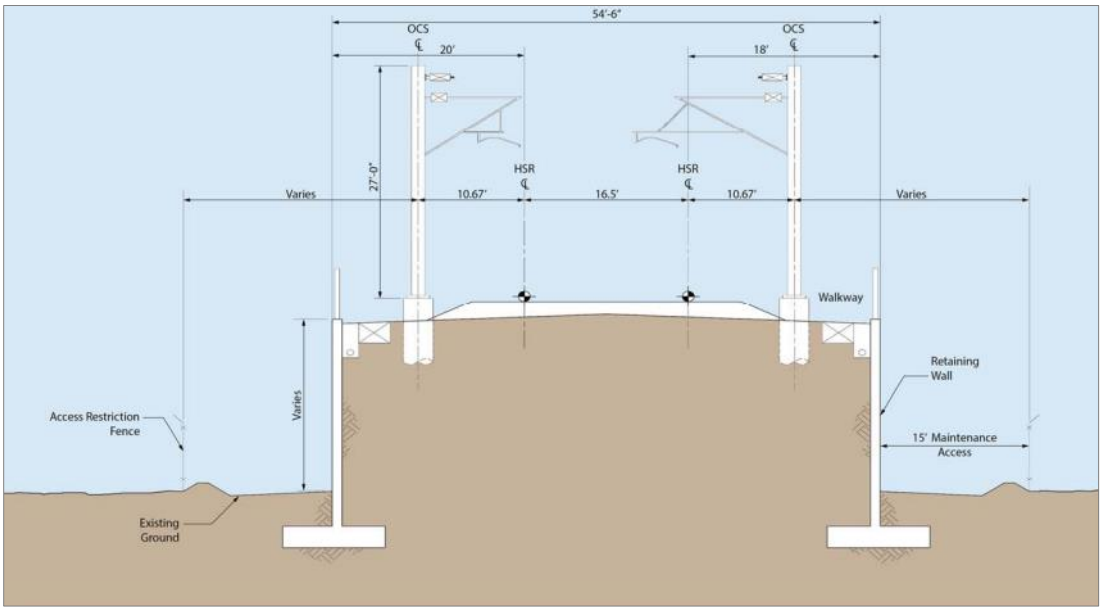


MARCH 2019

Figure 2-9 Typical At-Grade Cross Section for Blended System

2.4.4.2 Embankment Profile

Where the profile on earthen fill exceeds 5 feet in height, the profile is on embankment. Embankment of earthen fill is built with or without fill-retaining structures, depending on native ground stability and space available to place the HSR guideway. Retained-fill track profiles (Figure 2-10) are used where it is necessary to maintain a narrow right-of-way within a constrained corridor to minimize property acquisition. The guideway would be raised off the existing ground on a retained-fill platform made of reinforced walls, much like a freeway ramp.

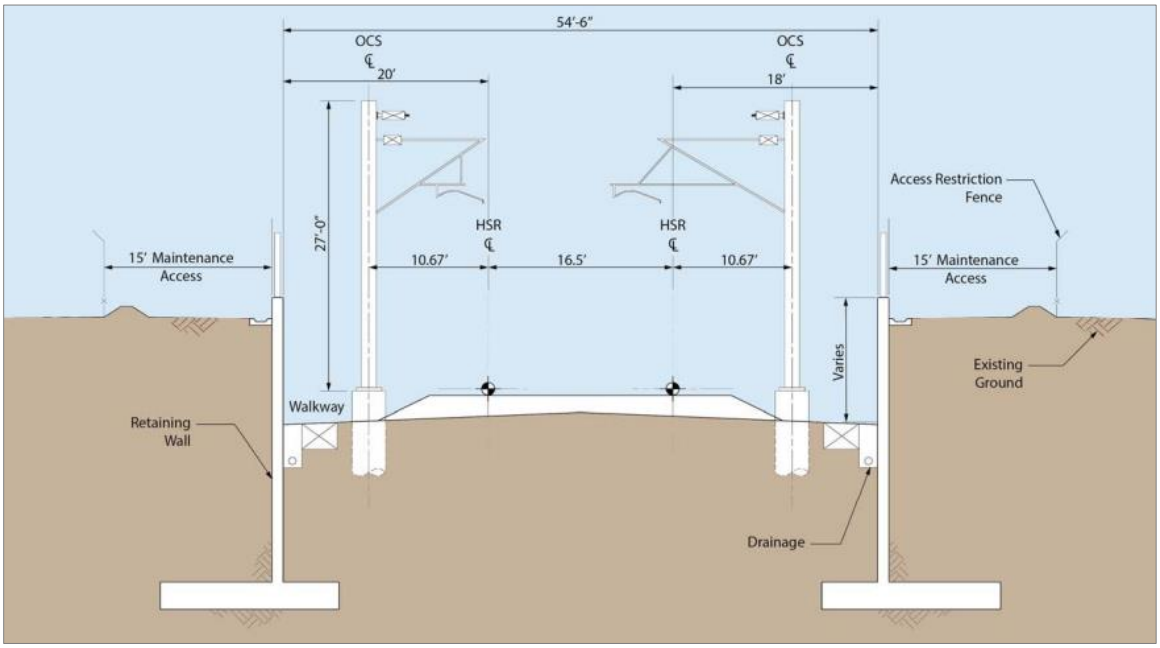


FEBRUARY 2017

Figure 2-10 Typical Retained-Fill Cross Section

2.4.4.3 Retained-Cut Profile

Retained-cut track sections (Figure 2-11) are used where the rail alignment crosses under existing rail tracks, roads, or highways that are at grade. This profile type is used only for short distances in highly urbanized and constrained situations. In some cases, it is less disruptive to the existing traffic network to depress the rail under these crossing roadways. Retaining walls would typically be needed to protect adjacent properties from extensive cut slopes. Retained-cut engineering is also used for roads or highways where it is more desirable to depress the roadway under an at-grade HSR alignment.



FEBRUARY 2017

Figure 2-11 Typical Retained-Cut Cross Section

2.4.4.4 Covered Trench Profile

Covered trench track profiles (Figure 2-12) are used when the rail alignment crosses under existing railroad tracks, roads, or highways that are at grade. This profile type is used in highly urbanized and constrained situations. In some cases, it is less disruptive to the existing traffic network to depress the HSR alignment under these crossing roadways. Covered trench engineering is also used for roads or highways where it is more desirable to depress the roadway underneath an at-grade HSR alignment.

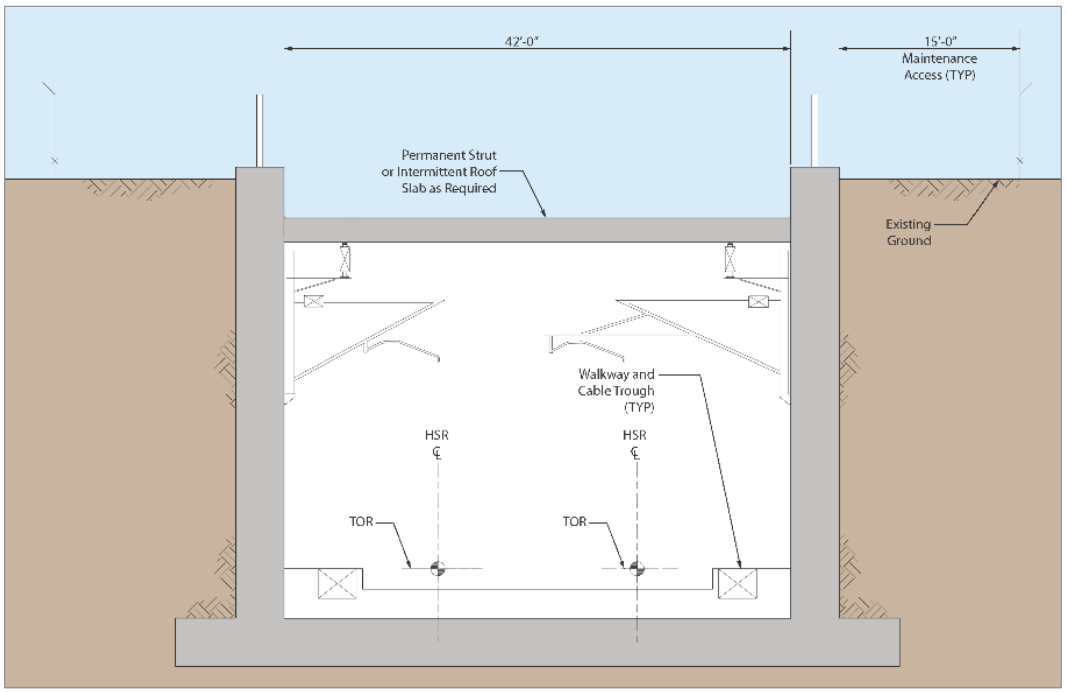
2.4.4.5 Tunnel Profile

Tunnel track profiles are used when the rail alignment traverses highly variable topography or highly constrained, densely developed urban situations. Tunnels reduce track distance and curvature needed to maintain acceptable vertical and horizontal grades in mountainous terrain. Tunnels may be used in dense urban settings to avoid land use or traffic disruptions. Figure 2-13 illustrates a typical twin-bored tunnel design, and Figure 2-14 illustrates the appearance of a typical tunnel portal. The tunnels east of Gilroy and through the Pacheco Pass would have long, flared portals and low blockage ratios and may also utilize in-tunnel cross-passages and vents to reduce noise pressure magnitudes and rates of rise to attenuate noise associated with the train entering or exiting the tunnels.

Tunnel portals and facilities would not be staffed. As specified in Technical Memorandum 2.4.6, *Tunnel Portal Facilities* (Authority 2010), lighting systems would be provided so that, during a train evacuation, illumination levels at the ground surface of the portal site area can be maintained at no less than 1.5 foot-candles (16 lux) in the following areas:

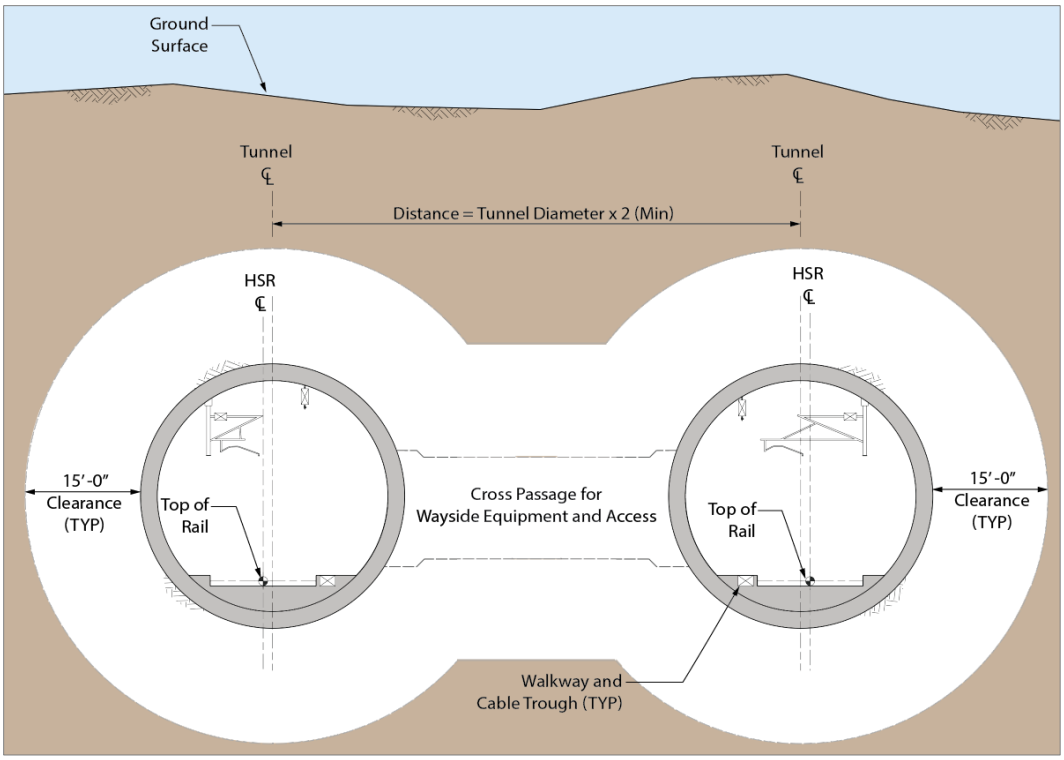
- Passenger assembly/rescue area
- Evacuation route from portal to rescue area
- Evacuation route from the train in the surface evacuation zone to the rescue area
- Emergency vehicle assembly and turnaround area
- Access road within the fenced portal site area

The emergency command post location (comprised of an emergency telephone, OCS motorized disconnect switch, portal lighting controls, and sufficient elements of a public address system to adequately support emergency responders) would be well lighted using site area lighting. Lighting layouts at tunnel portals would be as shown in Technical Memorandum 2.4.6, Appendix A, Infrastructure for Single Track Tunnel Portals, Typical Tunnel Portal Facilities (Authority 2010). Essential lighting would incorporate motion sensors, height limits, shielding, and downward-facing orientation where feasible.



APRIL 2017

Figure 2-12 Typical Covered Trench Cross Section



APRIL 2017

Figure 2-13 Typical Tunnel Cross Section

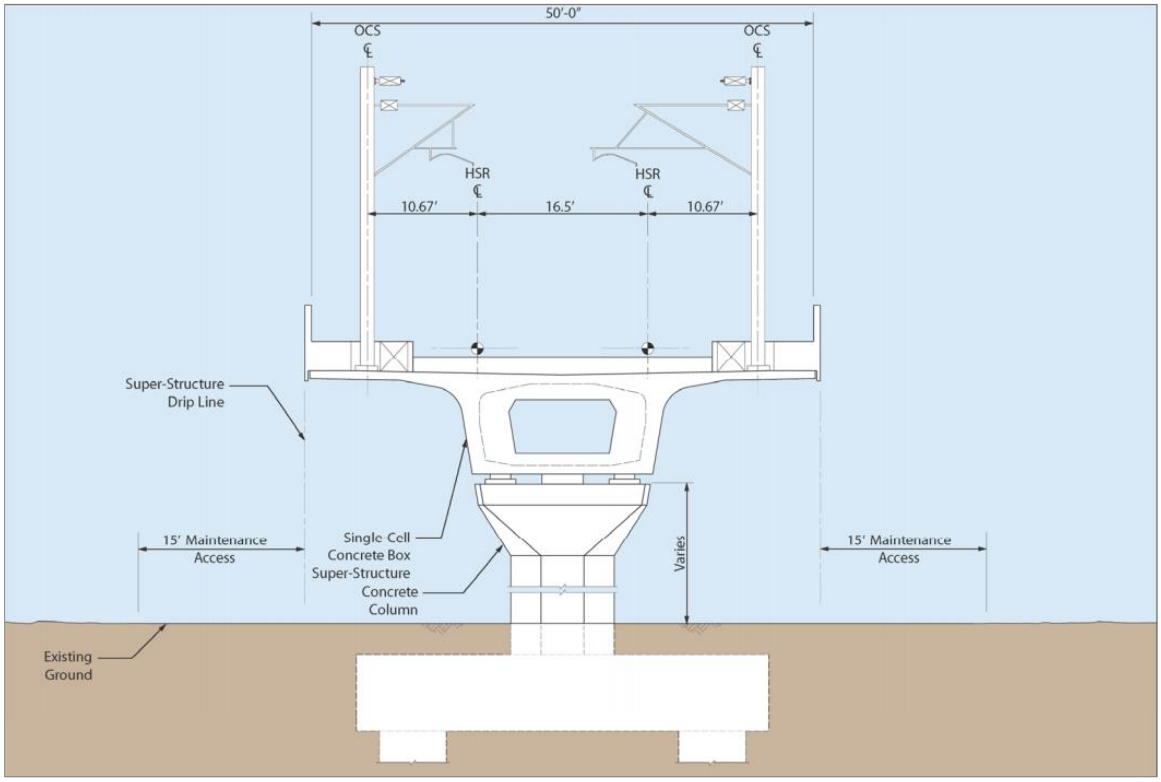
Source: Authority and FRA 2017a

FEBRUARY 2017

Figure 2-14 Tunnel Portal

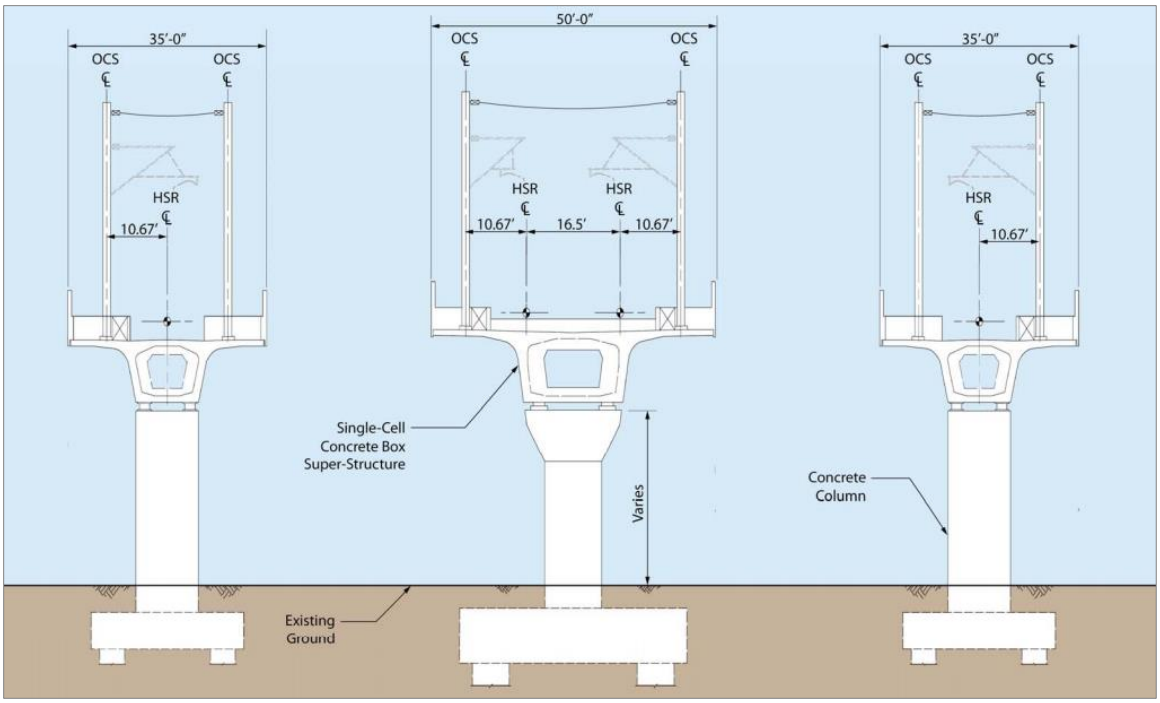
2.4.4.6 Elevated Profile

Elevated guideway track profiles (or viaducts) (Figure 2-15 and Figure 2-16) can be used in urban areas where extensive road networks must be maintained or to accommodate wildlife movement. An elevated guideway must have a minimum clearance of approximately 16.5 feet over roadways and approximately 24 feet over railroads. Pier supports are typically approximately 10 feet in diameter at the ground. Such structures could also be used to cross waterbodies; even though the trackway might be at grade on either side, the width of the water channel could require that a bridge be constructed to support a track contiguous with the at-grade guideway on either bank. Viaducts and bridge structures would only include lighting where needed for public safety, such as for street crossings, bicycle/pedestrian paths, and in urban areas.



FEBRUARY 2017

Figure 2-15 Two-Track Viaduct



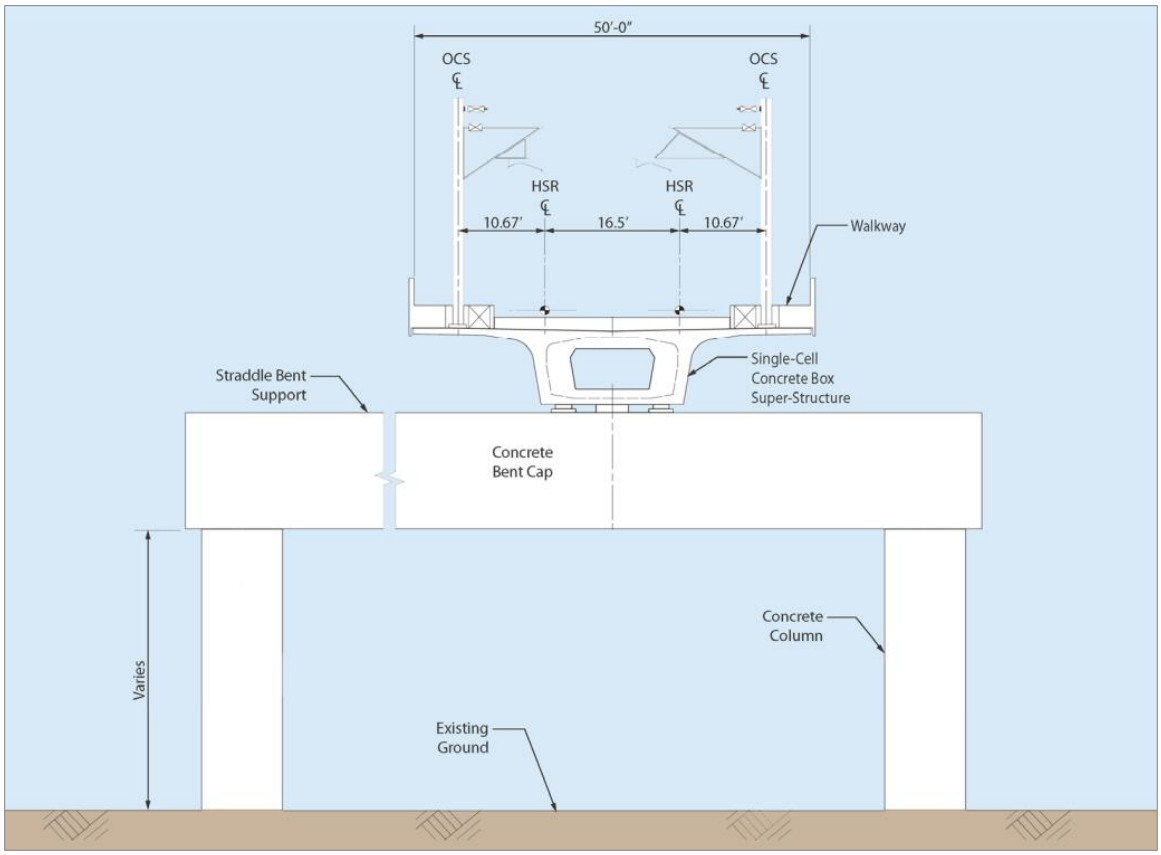
FEBRUARY 2017

Figure 2-16 Four-Track Viaduct

2.4.4.7 Straddle Bents

Where an HSR elevated track profile crosses over a roadway or railway on a very sharp skew (degree of difference from the perpendicular), a straddle bent is used to place the piers outside the functional or operational limit of the roadway or railway.

As illustrated on Figure 2-17, a straddle bent is a pier structure that spans (or *straddles*) the functional or operational limit of a roadway, highway, or railway. Typical roadway and highway crossings that have a smaller skew angle (i.e., approaching the perpendicular) generally use intermediate piers in medians and span the functional right-of-way. However, for larger skew-angle crossing conditions, median piers would result in excessively long spans that are not feasible. Straddle bents that clear the functional right-of-way can be spaced as needed (typically 110 feet apart) to provide feasible span lengths for bridge crossings at larger skew angles. Straddle bents would only include lighting where needed for public safety, such as for street crossings, bicycle/pedestrian paths, and in urban areas.



FEBRUARY 2017

Figure 2-17 Typical Straddle Bent Cross Section

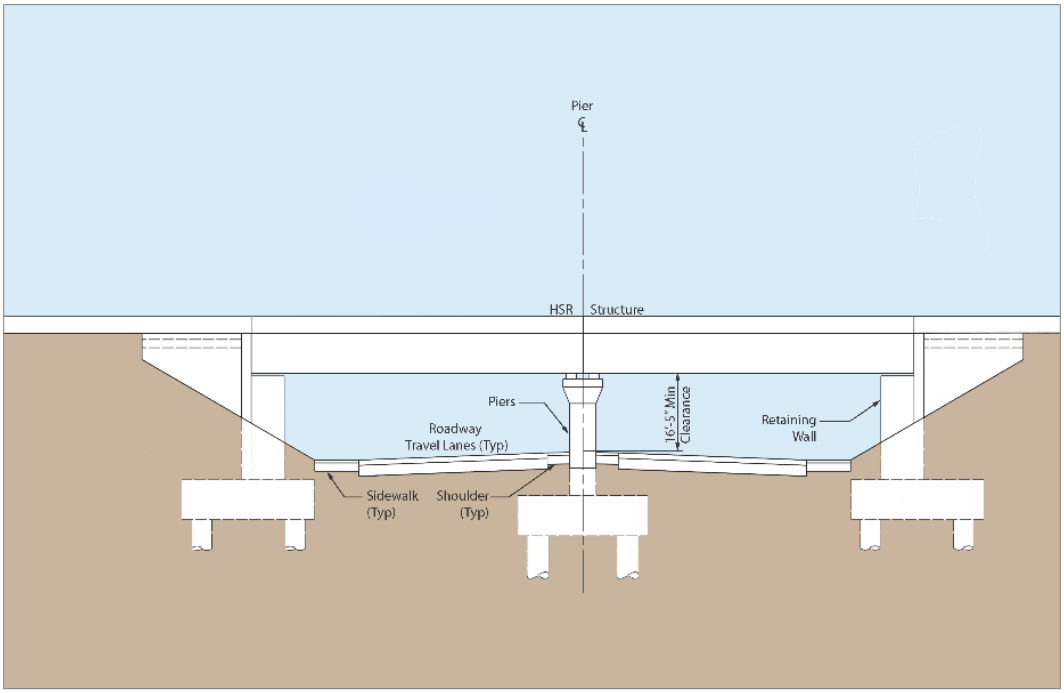
2.4.5 Grade Separations

Except in blended system areas (i.e., Alternative 4 or San Francisco to San Jose Project Section), the HSR system would consist of a fully grade-separated and access-controlled guideway. Unlike existing passenger service in the RSA (e.g., Caltrain), HSR would not share its rails with freight trains. Instead, HSR would operate in a shared right-of-way with two electrified tracks alongside one conventional freight track. For grade separations, the following would apply where consistent with safety, security, and operational requirements:

- Flood lighting or night lighting would not typically be installed for track operations or maintenance.
- Temporary, portable lighting would be used for maintenance.
- Essential lighting (for security or worker safety) would incorporate motion sensors, height limits, shielding, and downward-facing orientation where feasible.
- Roadway lighting would be provided based on roadway standards.

The following list describes possible scenarios for HSR grade separations at roadways, irrigation and drainage facilities, and wildlife crossings.

Elevated HSR road crossings—In urban areas, it may be more feasible to raise the HSR as illustrated on Figure 2-18. This is especially relevant in downtown urban areas where an elevated HSR guideway would minimize impacts on the existing roadway system. In instances where it is necessary to keep the profile of the elevated HSR guideway beneath certain height requirements, existing roadways would be moderately depressed (15 to 20 feet) to maintain vertical clearance requirements for vehicles.



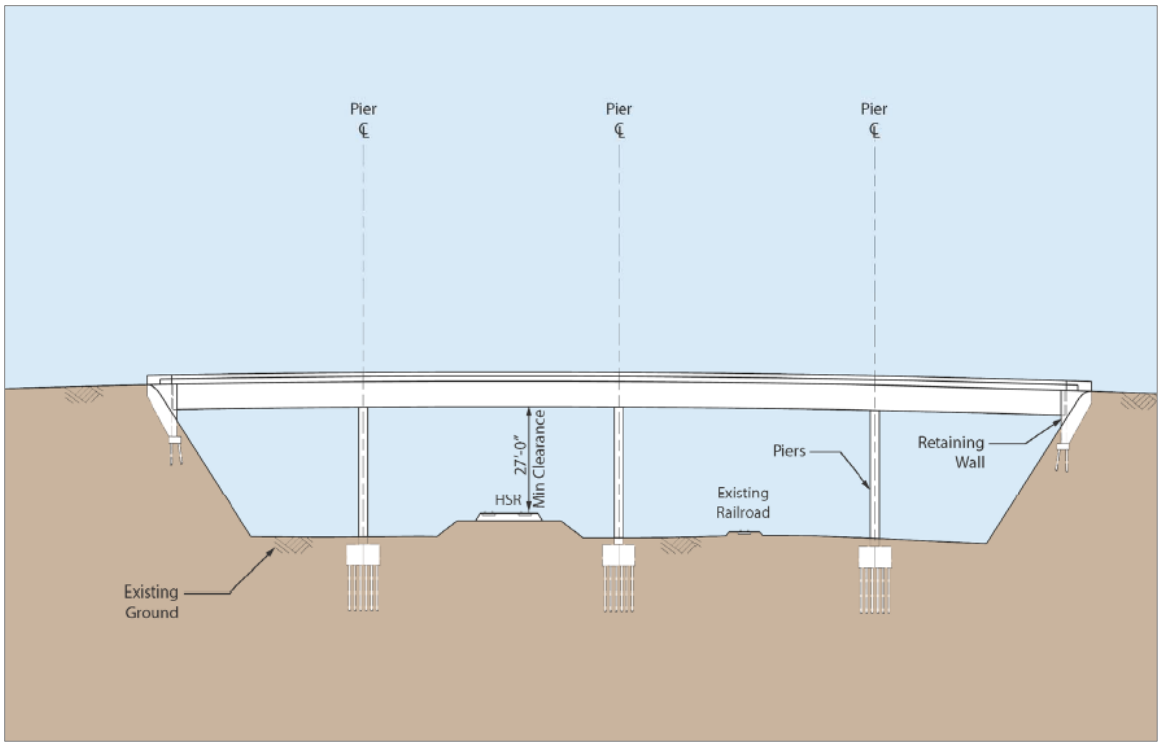
APRIL 2017

Figure 2-18 Elevated HSR Road Crossing

Roadway overcrossings—Many local roadways and state routes (SR) currently cross Union Pacific Railroad (UPRR) tracks at grade. Where such roadways intersect the proposed HSR alignment, they would be realigned and reconstructed to maintain their function. Figure 2-19 illustrates how a roadway would be grade-separated over both the HSR and the existing railroad. Similar conditions occur where an at-grade HSR alignment crosses rural roads used by small communities and farm operations. Where roads are perpendicular to the proposed HSR, overcrossings are planned every 2 miles to provide continued mobility for local residents and farm operations, but overcrossings may be provided at shorter intervals as warranted by existing roadway infrastructure. Some roads may be closed in the intervals between grade-separated crossings. These modifications are identified on project maps, and detailed lists are provided in Appendix 2-A. Roadway overcrossings would have two 12-foot-wide lanes. The shoulders would be 4 to 10 feet wide, depending on average daily traffic volumes. The paved surface for vehicles would therefore be 32 to 44 feet wide. Minimum clearance would be 27 feet above the HSR guideway. Specifications are based on the appropriate county or city road standards.

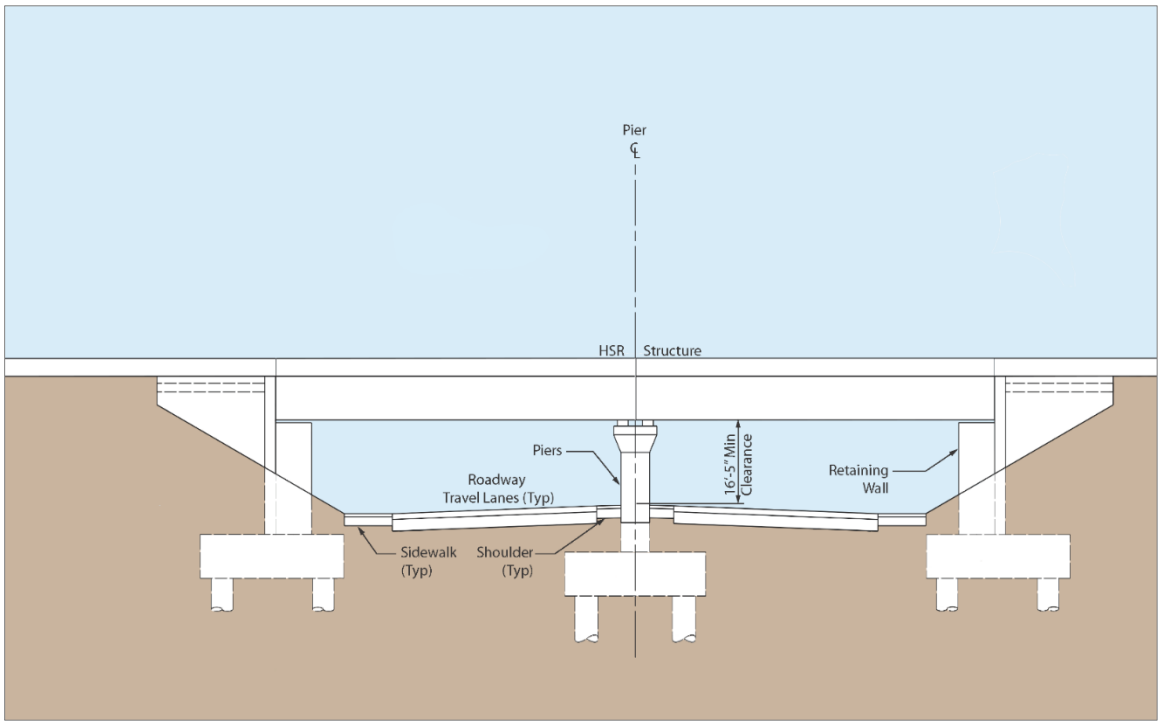
Roadway undercrossings—HSR alignments may require undercrossings for the HSR to travel over roadways. Figure 2-20 illustrates how a roadway would be grade-separated below the HSR guideway.

Irrigation and drainage facilities—The HSR guideway would affect some existing drainage and irrigation facilities. Depending on the extent of the effect, existing facilities would be modified, improved, or replaced as needed to maintain existing drainage, irrigation, and operational access functions and to support HSR drainage requirements.



FEBRUARY 2017

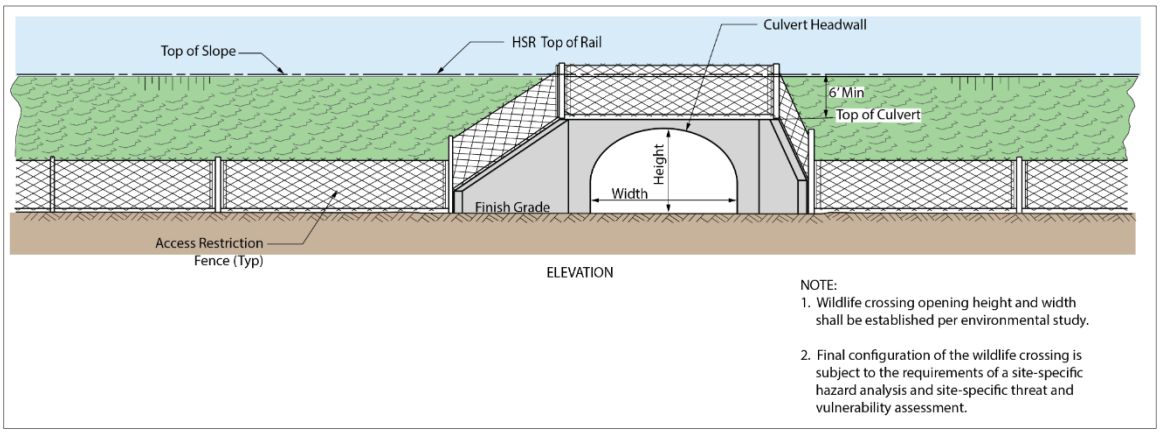
Figure 2-19 Road Overcrossing



FEBRUARY 2017

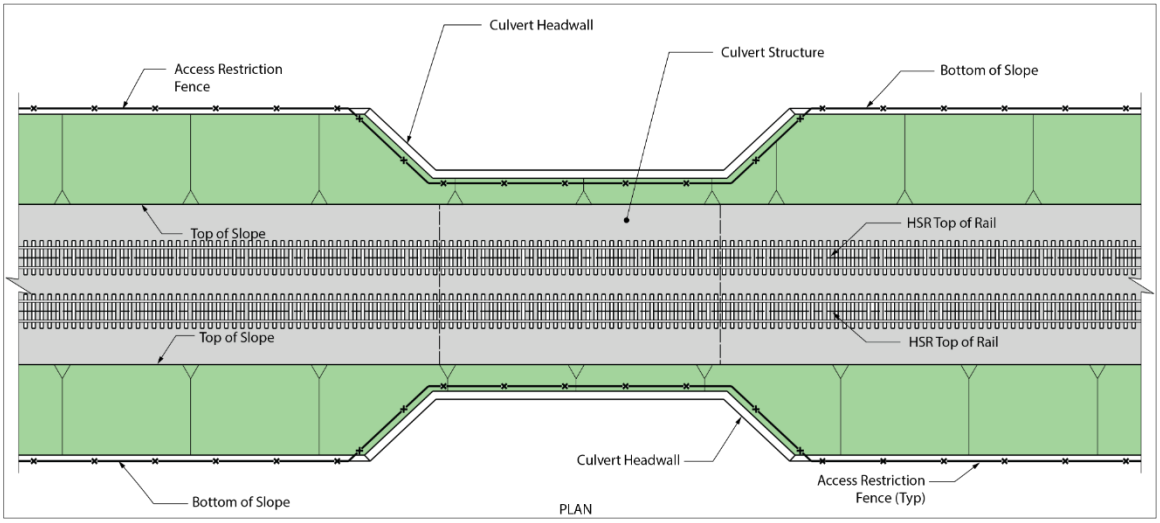
Figure 2-20 Typical Cross Section of Roadway Grade-Separated beneath HSR Guideway

Wildlife undercrossing structures—Wildlife undercrossings are modified culverts, perpendicular to the alignment, in the embankment that supports the HSR tracks. These features are illustrated on Figure 2-21 and Figure 2-22. The preliminary project design includes 96 wildlife undercrossing structures at roughly equal spacing along the embankment where the alignment is near ecologically sensitive areas.


Top of Slope
HSR Top of Rail
Culvert Headwall
6' Min
Top of Culvert
Height
Width
Finish Grade
Access Restriction Fence (Typ)
ELEVATION
NOTE:
1. Wildlife crossing opening height and width shall be established per environmental study.
2. Final configuration of the wildlife crossing is subject to the requirements of a site-specific hazard analysis and site-specific threat and vulnerability assessment.

JANUARY 2019

Figure 2-21 Typical Cross Section of Wildlife Crossing Structure



FEBRUARY 2017

Figure 2-22 Typical Plan View of Wildlife Crossing Structure

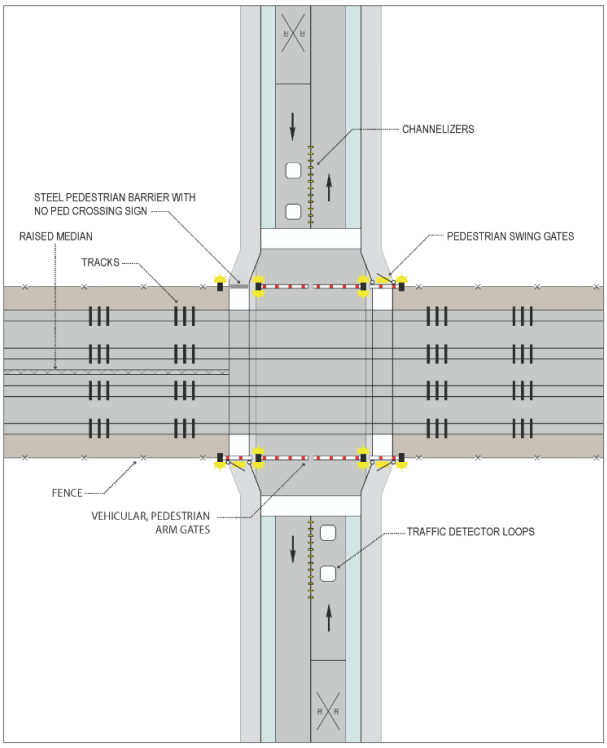
The wildlife undercrossing structures differ in dimensions (width, height, and length) by location. Wildlife crossings are proposed in three subsections: Morgan Hill and Gilroy, Pacheco Pass, and San Joaquin Valley. Standard HSR wildlife crossing structures in the Morgan Hill and Gilroy Subsection are 30 to 40 feet wide, 8 to 11 feet high, and 180 to 220 feet long. Wildlife crossings proposed in Pacheco Pass and the San Joaquin Valley Subsections must be a minimum of 10 feet wide and 3 feet high with an openness factor no less than 0.41 and no more than 1.5 feet below grade (half of the minimum vertical clearance). An *openness factor*, or *openness index*, is determined by multiplying the width and height of the crossing structure, then dividing the product by the length of the crossing. Generally, wildlife undercrossings are known to function best the greater the width and height and the shorter the length. For example, the Authority has

incorporated viaducts (elevated sections of the rail with a very high openness factor) into the project in ecologically sensitive areas, such as the Grasslands Ecological Area (GEA) in Merced County and the Soap Lake floodplain in southern Santa Clara and northern San Benito Counties. In some instances, viaduct structure is necessary to meet the requirements of wildlife crossing. Other structure designs (e.g., wildlife bridges, tunnels through berms) were deemed ineffective by both the Authority and wildlife stakeholders.

The analysis that determined the number, location, and design of wildlife undercrossings is described in the *San Jose to Merced Project Section: Wildlife Corridor Assessment Report* (WCA) (Appendix C of the *Biological and Aquatic Resources Technical Report* [Authority 2019b]). The WCA analyzes impacts on local movement corridors and recommends design refinements, including wildlife undercrossings, as necessary and as feasible to minimize impacts on wildlife movement. The WCA was informed by consultation with stakeholders and agency staff. The assessment identified ecologically sensitive areas for wildlife movement; locations where wildlife movement may be constrained for representative species; the appropriate location and sizes of dedicated crossings; and measures to avoid, minimize, or mitigate the effects of construction and operations. Section 3.7 of this Final EIR/EIS summarizes the findings of the WCA, describes modifications to the standard wildlife crossing structures where necessary, and proposes additional mitigation measures necessary to facilitate wildlife movement, to the extent such measures are feasible. These measures include additional design considerations, dedicated wildlife crossing structures, and compensatory mitigation.

2.4.6 At-Grade Crossings

Consistent with FRA safety guidelines for HSR systems with operating speeds of up to 110 mph, the blended, at-grade system would implement safety improvements at the at-grade crossings to create a “sealed corridor” that would reduce conflicts with automobiles, bicyclists, and pedestrians. Safety improvements would include installing four-quadrant gates extending across all lanes of travel and median separators to channelize and regulate paths of travel. These gates would prevent drivers from traveling in opposing lanes to avoid the lowered gate arms. Pedestrian crossing gates would be constructed aligned with the vehicular gates (i.e., parallel to the tracks) on both sides of the roadway. A total of 29 such four-quadrant gates are contemplated under Alternative 4. Details of these crossings are provided in Appendix 2-A. A representative schematic of a four-quadrant gate at-grade crossing is illustrated on Figure 2-23. Lighting at at-grade intersections would comply with roadway standards as well as safety standards for the quad gates.



Note: Location of proposed four-quadrant gate at-grade crossings can be found in Appendix 2-A, Table 3 JULY 2019

Figure 2-23 Typical Four-Quadrant Gate At-Grade Crossing

At four crossings (Blanchard Road, Palm Avenue, and Live Oak Avenue in Coyote Valley and Bloomfield Avenue south of Gilroy) within identified wildlife crossing corridors, additional features would be added at the grade crossings to deter wildlife from encroaching into the fenced guideway. These features would be placed across the guideway between the access control fencing and between the tracks as a deterrent to wildlife entering the track bed.

For at-grade crossings from south of Tamien Station in San Jose to south of Gilroy, the HSR project would add the following additional signal improvements:

- Addition of railroad preemption connected to adjacent traffic signals where not currently present (6): San Jose (Blanchard Road); Coyote Valley (Palm Avenue); Gilroy (Lewis Street, 6th Street, 7th Street, Luchessa Avenue)
- Addition of new traffic signals where not currently present and railroad preemption connected to the new signals (4): San Martin (Church Avenue), Gilroy (Rucker Avenue, Buena Vista Avenue, Cohansey Avenue)

Control of road traffic signals would be integrated with the HSR ATC system at those grade crossings where there are road traffic control systems that regulate the flow of traffic across rail/road crossings. This can be carried out through a one-way data exchange from the rail ATC system to road traffic control system. When the crossing barriers are triggered to operate, information is sent to the road system to ensure traffic signals are set to red prohibiting any road traffic from being directed towards or across the rail crossing. Once the barriers are released following the passage of a train a signal is sent to the road traffic system allowing it to enable the flow traffic across the crossing again. Data is not sent from the road system to the rail ATC system because the road traffic signals should never trigger the lowering or raising of rail crossing barriers.

A further safety improvement for at-grade crossings from south of Tamien Station to south of Gilroy would be the addition of obstacle detection. Obstacle detection usually takes the form of local radar and sometimes light detection and ranging (LIDAR) (i.e., low-level radar detection using lasers) installed at each crossing. The detection system uses radio waves (radar) and LIDAR to scan the area of the crossing road/rail interface to detect the presence or absence of road vehicles, people, animals, and other objects, which could otherwise obstruct the crossing and cause a potential collision with an oncoming train. Obstacle detection would be integrated into the ATC system so that when an approaching train is requesting movement authority from the ATC system to proceed along the railroad through a section containing crossings, the obstacle detection at each crossing in the section reports back through the ATC system that the crossing is clear of obstacles. Only when each crossing in that section has positively confirmed that (a) the barriers are down and (b) the crossing is clear of obstacles, is the train given movement authority by the ATC system to proceed.

For the portion of the alignment within the Caltrain corridor from south of Tamien Station to Scott Boulevard, as part of Alternative 4, the Authority would include the following features at the at-grade crossings at West Virginia Street and Auzerais Avenue:

- Installation of four-quadrant gates with new train detection and control equipment
- Addition of railroad preemption connected to adjacent traffic signals and integration with Caltrain signal operations, if feasible

Because these two at-grade crossings are within the Caltrain corridor, it is possible that railroad preemption (if feasible) may be installed by PCJPB as part of its other work; in this case, the Authority would fund the improvement and PCJPB would install and operate.

2.4.7 Traction Power Distribution

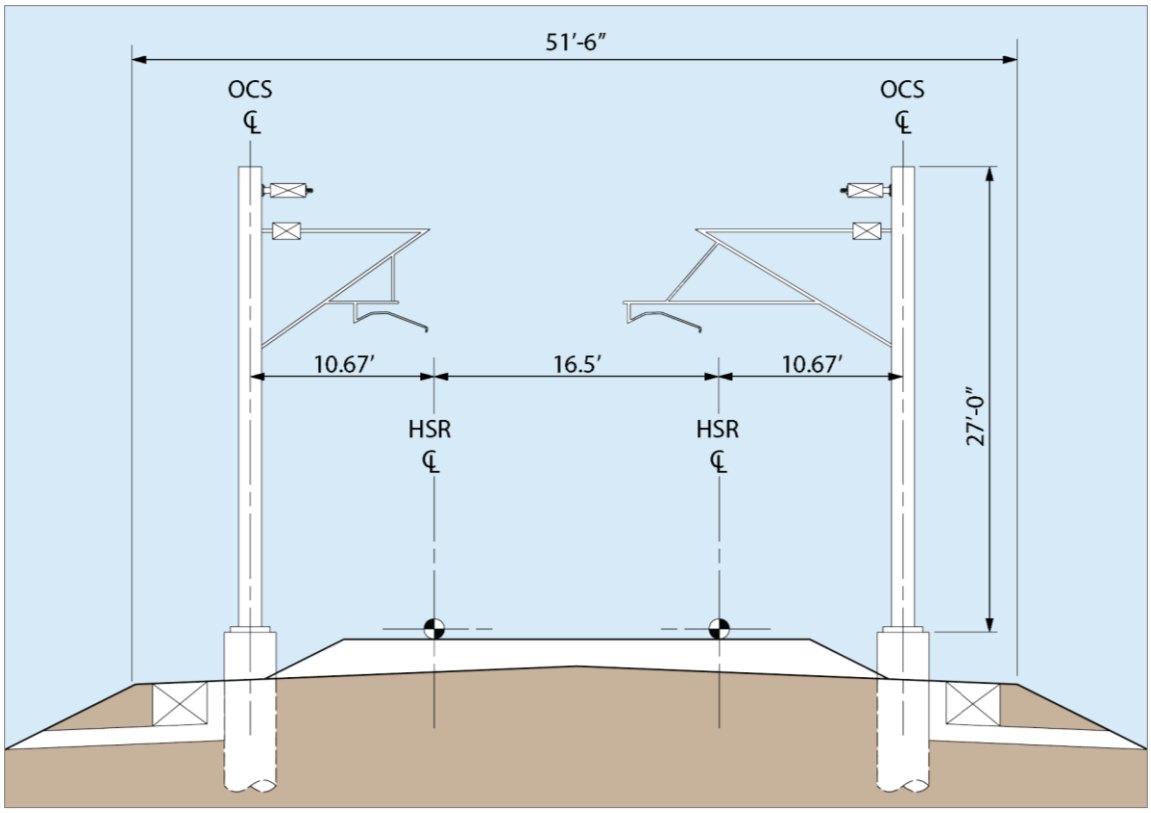
The HSR system would not entail construction of a separate power source, although it would require the extension of underground or overhead power transmission lines to a series of traction power substations (TPSS) positioned along the HSR corridor. These TPSSs are needed to even out the power feed from the power supply company to the train system. Working in coordination with power supply companies and in accordance with design requirements, the Authority has identified frequency and right-of-way requirements for these facilities. Trains would draw electric power from either an OCS (Figure 2-24) or an OCS strain gantry (Figure 2-25).

The OCS would consist of a series of mast poles approximately 23.5 feet higher than the top of the rail, with contact wires suspended from the mast poles, 17 to 19 feet above the top of the rail. The train would have an arm, called a pantograph, to maintain contact with this wire, providing power to the train. The mast poles would be spaced approximately every 200 feet along straight portions of the track, and as close as every 70 feet in tight-turn track areas. The OCS would be connected to the TPSSs. The power supply would consist of a 2- by 25-kilovolt (kV) OCS for all electrified portions of the statewide system. In some instances, a strain gantry would be used. A *strain gantry* involves a cantilevered OCS in areas where the right-of-way is narrow and only one mast pole can be accommodated.

For all power facilities, the following would apply where consistent with safety, security, and operational requirements:

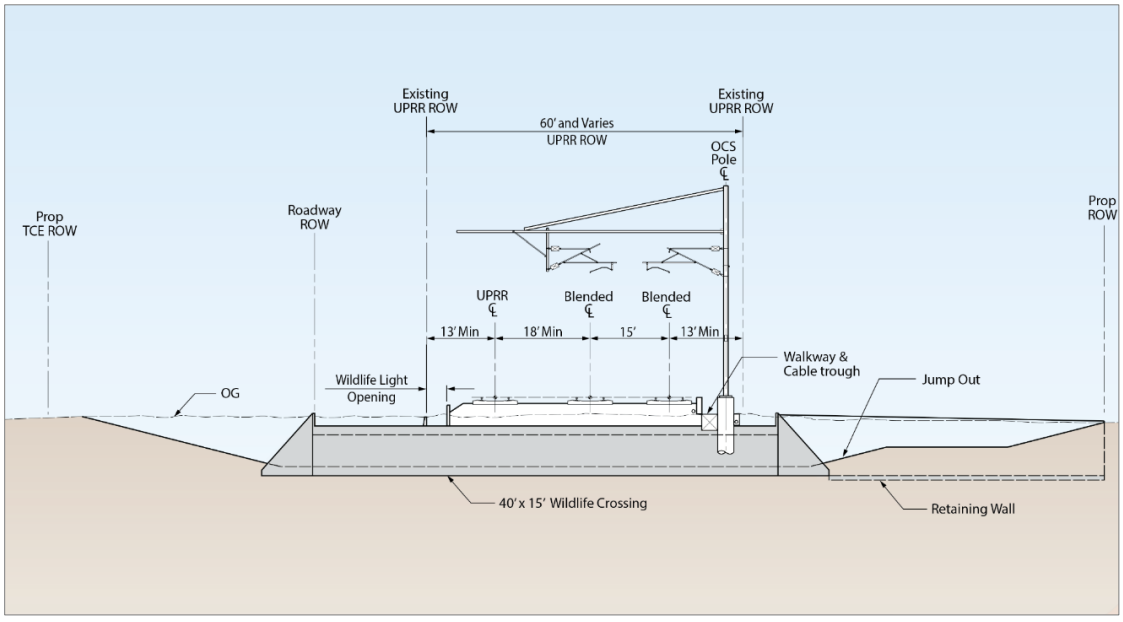
- Traction power facilities sites would not be staffed but would be lit 24 hours a day for security.
- Lighting would incorporate motion sensors, height limits, shielding, and downward-facing orientation where feasible.

Lighting would be used with CCTVs. In spaces where lighting is inappropriate due to environmental impacts, infrared receptors with infrared cameras or other appropriate technologies may be used.



FEBRUARY 2017

Figure 2-24 Typical Cross Section of Overhead Contact System



JANUARY 2019

Figure 2-25 Typical Cross Section of OCS Strain Gantry

2.4.7.1 Traction Power Substations

Based on the HSR system's estimated power needs, TPSSs would each encompass approximately 32,000 square feet (200 feet by 160 feet) at approximately 30-mile intervals. Figure 2-26 illustrates a typical TPSS.

Source: Authority and FRA 2017a FEBRUARY 2017

Figure 2-26 Traction Power Substation

The project would entail construction of three TPSSs, referred to as Site 3-San Jose, Site 4–tGilroy, and Site 5–O'Neill, at locations where high-voltage power lines cross the HSR alignment. Under Alternative 4, the Site 3–San Jose TPSS would not be required because equipment installed as part of the Peninsula Corridor Electrification Project (PCEP) would be used. Each TPSS would have two 115/50-kV or 230/50-kV single-phase transformers, both of which would be rated at 60 megavolt amperes. The autotransformer feed system would step down the transmission voltage to 50 kV (phase-to-phase), with 25 kV (phase-to-ground) to power the traction power distribution system. TPSSs would require a buffer area for safety purposes. The TPSS and associated feeder gantry (Figure 2-26) could be screened from view with a perimeter wall or fence. Each TPSS site would have a 20-foot-wide access road (or easement) from the street access point to the protective fence perimeter. Each site would require a parcel of up to 2 acres. Each TPSS would include an approximately 450-square-foot (18 by 25 feet) control room.

2.4.7.2 Traction Power Switching and Paralleling Stations

Traction power switching and paralleling stations work together to balance the electrical load between tracks and to switch power off or on to either track in the event of an emergency. Traction power switching stations (Figure 2-27) would be required at approximately 15-mile intervals, midway between the TPSSs. Each traction power switching station would encompass approximately 14,400 square feet (160 by 90 feet).

Traction power paralleling stations (Figure 2-28) would be required at approximately 5-mile intervals between the traction power switching stations and the TPSSs. Each traction power paralleling station would encompass approximately 9,600 square feet (120 by 80 feet), and each would include an approximately 450-square-foot (18 by 25 feet) control room. The traction power switching and paralleling stations and associated feeder gantries could be screened from view with perimeter walls or fences.

Source: Authority and FRA 2017a FEBRUARY 2017

Figure 2-27 Traction Power Switching Station

Source: Authority and FRA 2017a FEBRUARY 2017

Figure 2-28 Traction Power Paralleling Station

2.4.7.3 Backup and Emergency Power Supply Sources for Stations and Facilities

During normal system operations, the local utility would provide power service through the TPSSs. Should the flow of power be interrupted, the system would automatically switch to a backup power source through use of an emergency standby generator, an uninterruptable power supply, or a direct current battery system.

Permanent emergency standby generators for the project would be located at passenger stations and at terminal layup or storage and maintenance facilities. These standby generators must be tested (typically once a month) in accordance with National Fire Protection Association 110/111 to ensure their readiness for backup and emergency use. If needed, portable generators could also be transported to other trackside facilities to reduce the potential impacts of power failures on system operations.

2.4.7.4 Electrical Interconnection

As previously described, each TPSS would have two 115/50-kV or 230/50-kV single-phase transformers. These transformers would interconnect the TPSS to two breaker-and-a-half bays[6] constructed at a new utility switching station or within the fence line of an existing Pacific Gas and Electric Company (PG&E) facility via a short section of 230-kV transmission or 115-kV power lines (tie-line). Per Authority requirements, the proposed interconnection points would need redundant transmission (i.e., double-circuit electrical lines) from the point of interconnection, with each interconnection connected only to two phases of the transmission source. A new utility switching station would encompass approximately 35,200 square feet (160 by 220 feet) and include an approximately 975-square-foot (15 by 65 feet) control building, 525-square-foot (15 by 35 feet) battery building and, if required, a retention basin. The utility switching station could be screened from view with perimeter walls or fences. Communication facilities (i.e., redundant [two underground or one underground and one overhead on existing power structures] fiber optic lines) would also be required to support the electrical interconnections connecting TPSSs to new utility switching stations or to existing PG&E facilities, typically within tie-line/utility corridors.

2.4.8 Network Upgrades

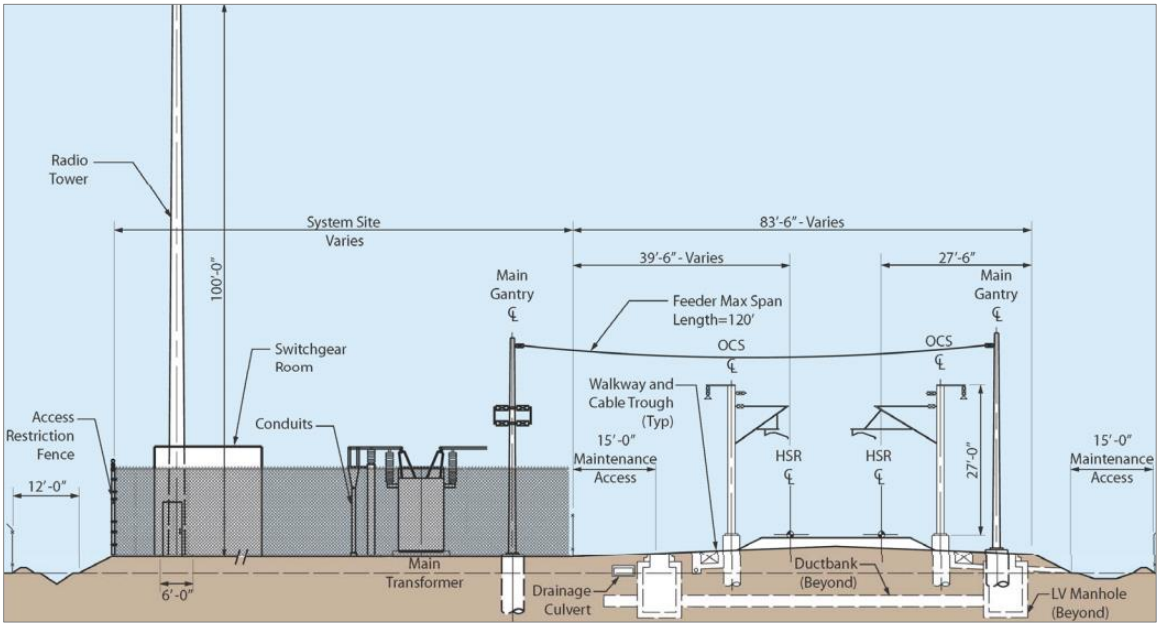
A 2016 technical study report completed by PG&E determined what network upgrades of existing infrastructure would be required to meet the projected power demands of the 345-mile portion of the HSR system within PG&E's service territory. The report (PG&E 2016) assumed maximum load during commercial operation at each TPSS location and normal system operation of all substations and transformers in its service area. The Authority is reviewing study results and planning to undertake only those upgrades that are required for operation of the HSR system as specified. These upgrades would not result in any unnecessary betterment of PG&E infrastructure. According to the PG&E report, the network upgrades required to support this project include the reconductoring of two existing 115-kV power lines co-located on the same structures and collocation of new power lines either on existing poles or underground where no poles exist. Lighting of network upgrades would comply with PG&E and Federal Aviation Administration (FAA) standards, for example for high power lines and towers. FAA requires structures above 200 feet above ground level to be marked with lights or paint. FAA-approved obstruction lighting may be red or white, flashing or steady-burning (FAA 2018). Other lighting would be temporary, portable, and as needed for maintenance. All network upgrades would be implemented pursuant to California Public Utilities Commission General Order 131-D. Appendix 2-F provides background information and a more detailed description of required components.

2.4.9 Signaling and Train-Control Elements

A computer-based, enhanced ATC system would control the trains. The enhanced ATC system would comply with the FRA-mandated positive train control (PTC) requirements, including safe separation of trains, over-speed prevention, and work zone protection. This system would use a wireless-based communications network that would include a fiber optical backbone and communications towers at intervals of approximately 1.5 to 3 miles, depending on the terrain and selected radio frequency. Signaling and train control elements within the right-of-way would include 10- by 8-foot communications shelters or signal huts/bungalows that house signal relay components and microprocessor components, cabling to the field hardware and track, signals, and switch machines on the track. Communications radio towers in these facilities would use a 6- to 8-foot-diameter 100-foot-tall pole. The communications facilities would be sited in the vicinity of track switches and would be grouped with other traction power, maintenance, station, and similar HSR facilities where possible. Where communications towers cannot be co-located with TPSSs or other HSR facilities, the communications facilities would be sited near the HSR corridor in a fenced area approximately 20 by 15 feet. ATC and standalone radio sites would not be staffed. Lighting would incorporate motion sensors, height limits, shielding, and downward-facing orientation where feasible while still meeting safety, security, and operational criteria. Fencing

[6] A *breaker and a half* is a common design of overlapping circuits and circuit breakers to provide system reliability.

around signaling and train control facilities may be screened. Lighting would be used with CCTVs. In spaces where lighting is inappropriate due to environmental impacts, infrared receptors with infrared cameras or other appropriate technologies may be used. Figure 2-29 illustrates a radio tower site.



FEBRUARY 2017

Figure 2-29 Typical Cross Section of At-Grade Profile with Traction Power, Signaling, and Train-Control Features

2.4.10 Track Structure

The track structure would consist of either a direct fixation system (with track, rail fasteners, and slab) or ballasted track, depending on local conditions and decisions to be made later in the design process. Ballasted track requires more frequent maintenance than slab track, as described below, but is less expensive to install.

The analyses in the environmental review documents assume that direct fixation would be used for track supported by structures longer than 1,000 feet and ballast for track supported by earthwork or structures shorter than 1,000 feet. A subsequent environmental review would be conducted if there is a significant change in the type of track structure following additional design and technical review.

2.4.11 Maintenance Facilities

The HSR system includes four types of maintenance facilities; this project section would have a maintenance of way facility (MOWF) and a maintenance of way siding (MOWS). A number of overnight layover and servicing facilities (MOWS) would be distributed throughout the system. In addition, the system would have a single heavy maintenance facility (HMF), which would be in the Central Valley outside of this project, as well as two light maintenance facilities (LMF). More information on the HMF sites considered can be found in the Merced to Fresno Section Final EIR/EIS and Fresno to Bakersfield Section Final EIR/EIS (Authority and FRA 2012, 2014).

2.4.11.1 Maintenance of Way Facility

MOWFs provide for equipment, materials, and replacement parts storage as well as support quarters and staging areas for the HSR system subdivision maintenance personnel. Each

subdivision would cover about 150 miles; the MOWF would be centrally located in the subdivision.

The MOWF would occupy a linear site adjacent to the HSR mainline tracks with a maximum width of seven tracks and would encompass approximately 50 to 75 acres (including tracks entering and exiting the facility). One MOWF would be constructed for the project at a location south or east of Gilroy. For lengths of mainline track that are relatively distant from stations with refuge tracks or MOWFs, an MOWS would be sited to provide temporary storage of work trains as they perform maintenance in the vicinity of the track. The track would be approximately 1,600 feet long and would be connected to the main line. Access by road for work crews would be required, along with enough space to park work crew vans while working from the site and to drive the length of the track. The track and access area would be within the fenced and secure area of the HSR line. Pole-mounted floodlights 50 to 100 feet tall would provide lighting for buildings, pathways, and trackwork. Fixed lighting sources would be designed to direct lighting downward, minimizing light spillover, but the 24-hour operation of the facilities would require a minimum level of lighting for work safety and security. Lighting would incorporate motion sensors, height limits, shielding, and downward-facing orientation where feasible while still meeting safety, security, and operational criteria. Lighting would be used with CCTVs. In spaces where lighting is inappropriate due to environmental impacts, infrared receptors with infrared cameras or other appropriate technologies may be used. Fencing around the MOWF would be screened.

2.4.11.2 Maintenance of Way Siding

MOWSs support maintenance activities by providing a location for layover of equipment and temporary storage of materials such as ballast and other bulk materials as well as secured storage for non-bulk materials. The goal is to reduce travel time required to arrive at the maintenance location by providing access via rail, thereby enhancing the efficiency and productivity of these activities. The project would include an MOWS near Turner Island Road in the San Joaquin Valley Subsection. Lighting at the MOWS would only be used when work is being undertaken at the siding; it is not expected that these would be in use all day every day. Pole-mounted floodlights 50 to 100 feet tall would provide lighting for buildings, pathways, and trackwork. Fixed lighting sources would be designed to direct lighting downward, minimizing light spillover, but the 24-hour operation of the facilities would require a minimum level of lighting for work safety and security. Lighting would incorporate motion sensors, height limits, shielding, and downward-facing orientation where feasible while still meeting safety, security, and operational criteria. Lighting would be used with CCTVs. In spaces where lighting would be inappropriate due to environmental impacts, infrared receptors with infrared cameras or other appropriate technologies may be used. Fencing around the MOWS would be screened. The MOWS is described in Section 2.6.2.2, Summary of Design Features.

2.5 Alternatives Considered during Alternatives Screening Process

The Authority has conducted the environmental review process for the project consistent with the programmatic decisions described in Section 1.1.2. A detailed presentation regarding the alternatives screening process is presented in Appendix 2-I.

The design options that are evaluated in this Final EIR/EIS were selected through the alternatives development and evaluation (screening) process described in Appendix 2-I. Table 2-3 shows the overall results of the alternatives screening process, and Figure 2-30 illustrates the process graphically.

Table 2-3 San Jose to Carlucci Road: Design Options Considered

Design Option	Decision		Reasons for Elimination (P = Primary; S = Secondary)							Environmental or Other Concerns
	Carried Forward	Withdrawn	Constructability	Cost	Community Effects (e.g., displacement, noise, visual)	Waters/Wetlands	Park Resources (Section 4f)	Other Natural or Cultural Resources	Incompatibility with Other Rail	
San Jose Diridon Approach Subsection										
1. Viaduct to Scott Blvd	X									Business displacement; biological, cultural, and parkland resources; visual effects
2. Viaduct to I-880	X									Business displacement; biological, cultural, and parkland resources; visual effects
3. RPA		X			P	S	S	S		Community effects: residential displacement, nonprofit (house of worship) displacement; noise; biological, cultural, visual, and park resources
4. Three Track		X			P				P	Inconsistent with Caltrain Operating Plan
5. South of Caltrain Tracks		X			P	S	S	S		Property effects; community effects; residential displacement; nonprofit (house of worship) displacement; noise/vibration; biological, cultural, visual, and park resources
6. Downtown Aerial		X	P		S			S		Residential/ business displacement; biological, cultural, and visual resources; community concerns; constructability issues
7. Deep Tunnel/Underground Station		X	P	S				S		Major constructability issues (poor soils, high groundwater, potential settlement); business displacement; cultural resources; construction effects; substantial costs
8. Shallow Tunnel/ Underground Station		X	P	S		S		S	S	Relocation (lowering) of proposed BART station under HSR Station in poor soils/high groundwater; lowering of BART tunnels; impacts on Los Gatos Creek from cut-and-cover construction; business displacement; cultural resources; construction effects; substantial costs.
9. Blended, At-Grade	X									Disruption and noise effects; biological, cultural, and parkland resources

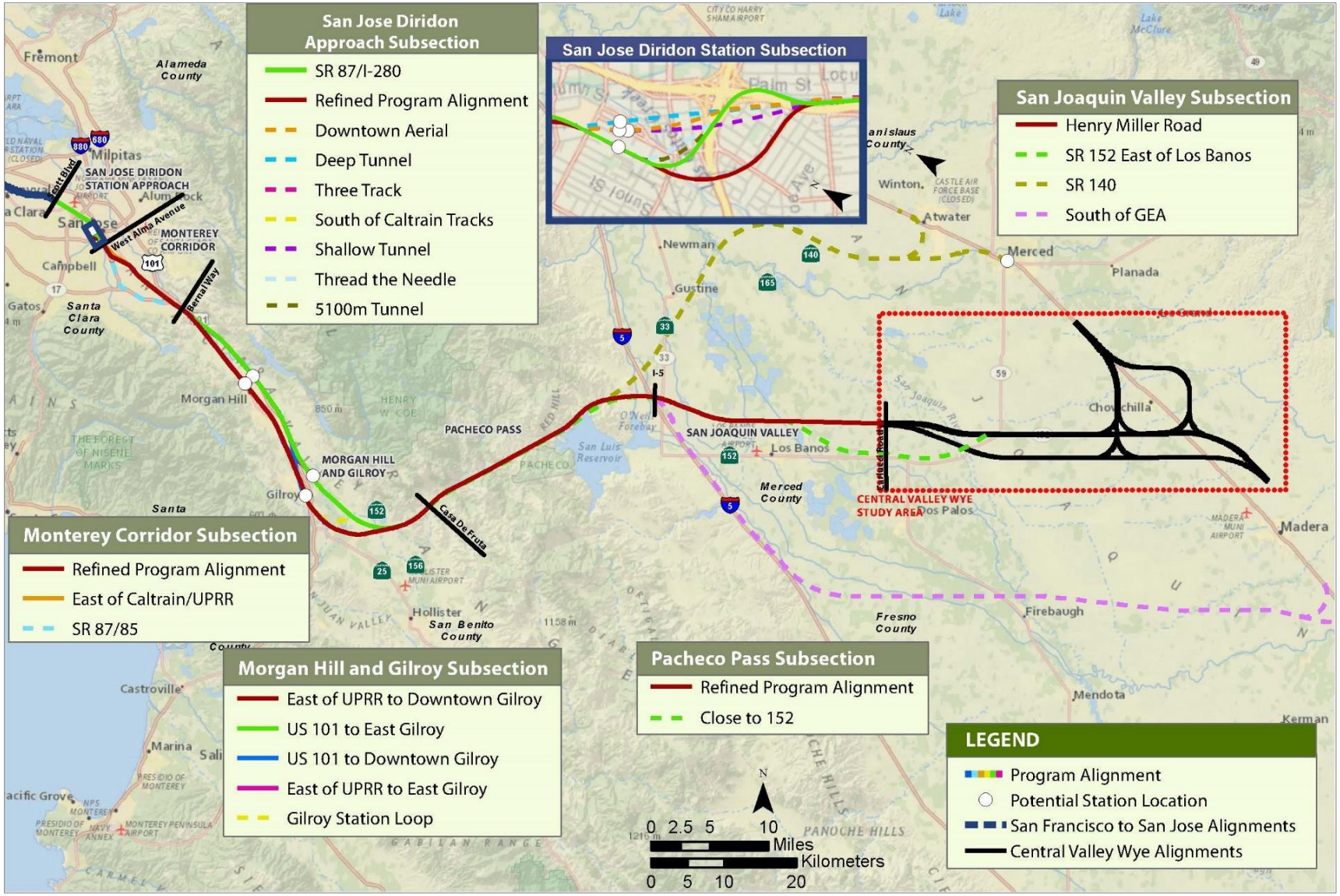
Design Option	Decision		Reasons for Elimination (P = Primary; S = Secondary)							Environmental or Other Concerns
	Carried Forward	Withdrawn	Constructability	Cost	Community Effects (e.g., displacement, noise, visual)	Waters/Wetlands	Park Resources (Section 4f)	Other Natural or Cultural Resources	Incompatibility with Other Rail	
Monterey Corridor Subsection										
1. Median Viaduct	X									Visual effects, traffic effects during construction and operation, noise, property acquisition
2. At-Grade (RPA)	X									Visual effects, traffic effects during construction and operation, noise, property acquisition
3. SR 87/SR 85		X			P				P	Community effects and displacements in areas outside road ROW, displacement of VTA light rail line, substantial costs due to relocation
4. US 101/I-280		X			P		P			Community effects and displacements in areas outside road ROW, effects on parkland south of SR 85
5. US 101 to Monterey Rd via SR 85		X			P		P			Community effects and displacements in areas outside road ROW, effects on parkland south of SR 85
6. US 101 to Monterey Rd via Blossom Hill Road		X			P		P			Community effects and displacements in areas outside road ROW, effects on parkland south of SR 85
7. Cut-and-Cover Tunnel on Monterey Rd		X		P				S		Prohibitive cost (approximately twice the cost of median viaduct option), groundwater hydrology and supply effects
8. Bored Tunnel on Monterey Rd		X		P				S		Prohibitive cost (approximately 2.5 times the cost of median viaduct option), groundwater hydrology and supply effects
9. Blended, At-Grade	X									Traffic effects during construction and operation, noise

Design Option	Decision		Reasons for Elimination (P = Primary; S = Secondary)							Environmental or Other Concerns
	Carried Forward	Withdrawn	Constructability	Cost	Community Effects (e.g., displacement, noise, visual)	Waters/Wetlands	Park Resources (Section 4f)	Other Natural or Cultural Resources	Incompatibility with Other Rail	
Morgan Hill and Gilroy Subsection										
1. Viaduct to Downtown Gilroy via Morgan Hill Bypass (including MOWF Site D)	X									Visual effects, traffic effects during construction and operation, noise, property acquisition and displacement, cultural resources, floodplain
2. Embankment to Downtown Gilroy (including MOWF Site D)	X									Traffic effects during construction and operation, noise, property acquisition and displacement, cultural resources farmland, floodplain
3. Viaduct to East Gilroy via Morgan Hill Bypass (including MOWF Site C)	X									Visual effects, traffic effects during construction and operation, noise, property acquisition, cultural resources, floodplain
4. US 101 Alignment to Downtown Gilroy		X				P	P	P		Aquatic resources, threatened and endangered species habitat, floodplains, farmlands, parks (4f resources), land use disruption from tunnel/trench near airport
5. US 101 Alignment to East Gilroy		X				P	P	P		Aquatic resources, threatened and endangered species habitat, farmlands, parks (4f resources)
6. East of UPRR to East Gilroy		X			P			P		Threatened and endangered species habitat, built environment cultural resources, residential displacements, floodplains, farmlands, land use disruption from US 101 crossover
7. West of Coyote Creek to Downtown Gilroy		X				P	P	P		Aquatic resources, threatened and endangered species habitat, built environment cultural resources, parks (4f resources), floodplains, farmlands, land use disruption from tunnel/trench near airport
8. West of Coyote Creek to East Gilroy		X				P	P	P		Aquatic resources, threatened and endangered species habitat, built environmental cultural resources, parks (4f resources), floodplains, farmlands, land use disruption

Design Option	Decision		Reasons for Elimination (P = Primary; S = Secondary)							Environmental or Other Concerns
	Carried Forward	Withdrawn	Constructability	Cost	Community Effects (e.g., displacement, noise, visual)	Waters/Wetlands	Park Resources (Section 4f)	Other Natural or Cultural Resources	Incompatibility with Other Rail	
9. Gilroy Station Loop		X		P	P					Substantially higher cost of multiple alignments, visual effects of multiple alignments.
10. Foothills		X						P		Threatened and endangered species habitat, poor connectivity of potential station
11. Downtown Gilroy Tunnel		X		P				S		Prohibitive cost (approximately 2 to 2.5 times the cost of median viaduct option), groundwater hydrology and supply effects
12. Morgan Hill to Gilroy Tunnel		X		P				S		Prohibitive cost (approximately 2 to 2.5 times the cost of median viaduct option), groundwater hydrology and supply effects
13. Gilroy US 101 Alignment		X		P	P					Higher cost and no benefits compared to downtown alignments. Would also be inconsistent with TOD policies of Authority.
14. Blended, At-Grade (including South Gilroy MOWF)	X									Traffic effects during construction and operation, noise, property acquisition and displacement, cultural resources, farmland, floodplain
▪ Maintenance Facility "A"		X					P	P		Coyote Creek Regional Park, wildlife movement, farmland
▪ Maintenance Facility "B"		X					P	P		Coyote Creek Regional Park, wildlife movement, farmland
Pacheco Pass Subsection										
1. Tunnel	X									Threatened and endangered species habitat, water quality (dewatering), spoils placement
2. Proximity to SR 152		X				P	P	P		San Luis Reservoir, Cottonwood Creek Wildlife Area, threatened and endangered species habitat, waters/wetlands, floodplains
3. RPA		X				P	P	P		San Luis Reservoir, Cottonwood Creek Wildlife Area, threatened and endangered species habitat, waters/wetlands, floodplains

Design Option	Decision		Reasons for Elimination (P = Primary; S = Secondary)							Environmental or Other Concerns
	Carried Forward	Withdrawn	Constructability	Cost	Community Effects (e.g., displacement, noise, visual)	Waters/Wetlands	Park Resources (Section 4f)	Other Natural or Cultural Resources	Incompatibility with Other Rail	
San Joaquin Valley Subsection										
1. Henry Miller Rd to Carlucci Rd	X									Farmlands and dairies, wetlands/waters, traffic effects during construction and operation, noise, residential and commercial displacement
2. GEA North/Merced		X				P	P			Aquatic resources, North Grasslands Wildlife Area, state park crossing
3. South of GEA		X	S	S		P				Aquatic resources, high cost, and logistical issues because of longer alignment
4. GEA Tunnel		X		P						Substantially more expensive than aboveground embankment or viaduct approaches, even when including aboveground mitigation in the form of noise barriers or enclosures
5. Viaduct Crossing of the Whitworth Road overcrossing of I-5/Viaduct west of I-5		X			P					Reconstruction and realignment of the Whitworth Road interchange, resulting in additional impacts on prime farmland The viaduct alignment to the west of I-5 would not provide any environmental advantages.

BART = Bay Area Rapid Transit; GEA = Grasslands Ecological Area; HSR = high-speed rail; MOWF = maintenance of way facility; P = Primary; ROW = right-of-way; RPA = Refined Program Alignment; S = Secondary; SR = State Route; TOD = transit-oriented development; US = U.S. Highway; VTA = (Santa Clara) Valley Transportation Authority



Source: Authority and FRA 2010

JANUARY 2020

Figure 2-30 Alignment Alternatives Carried Forward into EIR/EIS as Identified in the Preliminary Alternatives Analysis Report

2.6 Alignments, Station Sites, and Maintenance Facilities Evaluated in this Final EIR/EIS

This section describes the No Project Alternative and the four end-to-end project alternatives.

2.6.1 No Project Alternative—Planned Improvements

The National Environmental Policy Act (NEPA) requires the evaluation of a No Action Alternative in an EIS (CEQ Regulations § 1502.14(d))[7]. Similarly, CEQA requires that an EIR include the evaluation of a No Project Alternative (CEQA Guidelines § 15126.6(e)). The No Project Alternative (synonymous with the NEPA No Action Alternative) considers the effects of conditions forecast by current plans for land use and transportation in the project vicinity, including planned improvements to the highway, aviation, conventional passenger rail, freight rail, and port systems through the 2040 planning horizon for the environmental analysis if the proposed project is not built.

2.6.1.1 Projections Used in Planning

The project alignment crosses Santa Clara, San Benito, and Merced Counties. Over the next 25 years, population is projected to increase in these counties by more than 22 percent, about 47 percent, and about 45 percent, respectively (Table 2-4). Table 2-4 also shows the projected 2040 total employment; most of the region's job growth is anticipated in Santa Clara County, consistent with the region's current distribution of jobs. The projections show that employment in San Benito County would grow at the highest rate of the three counties, while Merced County would experience the slowest job growth over the next 25 years. The region overall is expected to experience a job growth rate that is lower than the statewide average over the next 25 years. Despite the economic downturn of a decade ago, which temporarily slowed growth, 2040 projections show 575,091 new inhabitants and 261,459 new jobs in this region, primarily in Santa Clara County.

Table 2-4 Regional Projected Population and Employment Projections, 2015 and 2040

	2015	2040 Projections	Percent Change
Population[1]			
State of California	38,907,642	47,233,240	21.4
Santa Clara County	1,903,974	2,331,887	22.5
San Benito County	56,445	82,969	47.0
Merced County	269,280	389,934	44.8
Regional Total	**2,229,699**	**2,804,790**	**25.8**
Employment[2]			
State of California	16,474,800	20,895,900	26.84
Santa Clara County	1,032,200	1,273,516	23.38
San Benito County	16,200	20,190	24.63
Merced County	77,500	93,653	20.84
Regional Total	**1,125,900**	**1,387,359**	**23.22**

[7] The Council on Environmental Quality issued new regulations on July 14, 2020, effective September 14, 2020, updating the NEPA implementing procedures at 40 C.F.R. Parts 1500-1508. However, this project initiated NEPA before the effective date and is not subject to the new regulations, relying on the 1978 regulations as they existed prior to September 14, 2020. All subsequent citations to Council on Environmental Quality regulations in this environmental document refer to the 1978 regulations, pursuant to 40 C.F.R. 1506.13 (2020) and the preamble at 85 Fed. Reg. 43340.

[1] CDOF 2014, 2016
[2] CEDD 2016; Caltrans 2015

2.6.1.2 Planned Land Use

The evaluation of the No Project Alternative considers planned transportation, housing, commercial, and other development projects through the planning horizon year 2040. Appendices 3.19-A and 3.19-B describe foreseeable future development projects—shopping centers, large residential developments, and planned transportation projects defined in the various regional transportation plans for each of the three counties. The discussion that follows highlights the larger projects along the project extent during the 20-year planning horizon, but it is not an exhaustive description of all planned development in the three counties.

Planned projects in the San Jose Diridon Station Approach and Monterey Corridor Subsections within the city of San Jose include medical office, hotel, residential, and mixed-use development; an office/data center; and shopping center expansion. The City of San Jose entered into an exclusive negotiating agreement with Google for 16 city-owned parcels in June 2017. Google is proposing an 85-acre downtown campus (the Downtown West project) with 6 million to 8 million square feet of tech office and research and development; additional amenities would include open space, entertainment, and retail with housing within the 250-acre Diridon Station Area Plan area; the project was approved by the City of San Jose in May 2021. Subsequent to the agreement with the City of San Jose, Google and its development partners are continuing to acquire public and private properties, further expanding their land holdings in the station area, including commercial, industrial, government, parking, and retail sites. North of San Jose Diridon Station, a seven-story mixed-use development is under construction and nearly completed on Stockton Avenue. Other pending development projects include 785–807 Alameda, City Place Project in Santa Clara, and the (Santa Clara) Valley Transportation Authority's (VTA) Transit-Oriented Joint Development at the San Jose, Santa Clara, and Tamien stations. A four- to five-story mixed-use development is planned at the intersection of Delmas and Park Avenues, and 120 condominiums are proposed for Delmas Avenue between West San Carlos Street and Auzerais Avenue, south of the station. A substantial amount of development is proposed east and north of the junction of SR 87 and Interstate (I-) 280 as well as south of I-280. Development is planned south of Cottle Street on the west side of Monterey Road consisting of 2,728 dwelling units, 506,000 square feet of commercial uses, and 1.7 million square feet of industrial uses. A phased multifamily residential project is moving forward on Communications Hill adjacent to the proposed project alignment.

Pending major transit-related projects in San Jose include the Capitol Corridor Joint Powers Authority Oakland to San Jose Phase 2 Double Track (Segment 2A), Bay Area Rapid Transit (BART) Silicon Valley Extension from Warm Springs to Santa Clara, Caltrain Modernization Program, Capitol Expressway Light Rail Transit (LRT) Extension Phase 2, LRT Extension Winchester Station to Vasona Junction, El Camino Real bus rapid transit (BRT) improvements, Stevens Creek Corridor BRT improvements, and various improvements to light rail structures and switches. Various improvements to state highways within the city, including conversion to high-occupancy vehicle (HOV) lanes and interchange modifications, are also planned, in addition to Caltrain double-tracking between San Jose and Gilroy and widening of Almaden and Lawrence Expressway.

In the Morgan Hill and Gilroy Subsection, a 517,000-square-foot industrial project is planned on the west side of Monterey Road. Commercial and industrial development, including a recreation center and medical offices, is planned or underway along U.S. Highway (US) 101 in Morgan Hill, as well as a 657,000-square-foot retail center at US 101 and Cochrane Road. Several single- and multifamily residential projects are also under construction or approved, including eight units of affordable housing at the southwest corner of Monterey Road and Ciolino Avenue; a 14-unit, multifamily, affordable apartment complex on East Dunne Avenue; and 19 affordable, below market rate, multifamily apartments on the west side of Monterey Road. A mixed-use development is planned for the southwestern side of Monterey Road northwest of Watsonville Road. US 101/Tennant Avenue Interchange Improvements are also planned. A major sports

complex—the Southeast Quadrant Ball Fields—is planned for a 26-acre site east of and adjacent to the northbound US 101/Tennant Avenue off-ramp.

In Gilroy, a residential subdivision is planned on 2.67 acres for six single-family residential units south of Santa Teresa Boulevard in the Eagle Ridge Planned Unit Development. Other planned residential projects in Gilroy include the Wren Avenue Gilroy Unified School District Residential Project (70 single-family dwelling units) and the Santa Teresa Boulevard Townhouse Project (205 multifamily residential units). Affordable senior units (75 dwelling units) are planned on a 1.86-acre site in the downtown district. A four-story, 65,120-square-foot 100-room hotel with an outdoor pool and an adjacent property (5955 Travel Park Circle) is planned east of US 101 and southeast of the Monterey Road and Travel Park Circle intersection in south Gilroy. Other planned development includes a four-story apartment complex in the Cannery District, a mixed multifamily residential and commercial use development along Monterey Road, two new single-family subdivisions, a new fire station, a 350,000-square-foot distribution center, and new office and self-storage uses. Various intersection improvements are planned throughout Gilroy, as well as a new overcrossing at Las Animas Avenue.

In San Benito County, planned development includes a proposed solar energy generation facility on 2,506 acres and an age-restricted retirement development including 1,084 homes, up to 65,000 square feet of neighborhood commercial, a 200-room resort hotel, a 4-acre assisted living/skilled nursing/memory care facility with up to 100 beds, 6.6 acres of neighborhood parks, a 16.8-acre community park, 114 acres of open space, 41 acres of agricultural preserve, and a 1,243-acre permanent wildlife habitat preserve. This retirement community would be located 3 miles southwest of the city of Hollister, 3.5 miles southeast of the city of San Juan Bautista, and 1 mile south of SR 156 in San Benito County. Approximately 0.5 mile south of Hollister, a 200-unit residential community was approved in 2016. SR 156 is proposed as a four-lane expressway and widening of Fairview Road and SR 25 is also proposed.

In Merced County, expansion of the existing Liberty Packing Company, a tomato processing facility, is planned. Additional development includes the George Reed, Inc. Merced Quarry Project and Reclamation Plan to modify its Conditional Use Permit to allow for mining to a depth of approximately 25 feet below grade level, into the perched-water zone; to operate an asphalt batch plant and a Portland cement concrete batch plant; and to change the current reclamation plan's end use from agricultural to open space with wildlife and naturally occurring vegetation. The proposed project would also amend the County General Plan land use designation of an approximately 70-acre portion of the property from Snelling RRC No. 1, Residential to Agricultural and would rezone the property from Agricultural Residential (A-R) to General Agricultural (A-1). A 211-unit residential subdivision on 45.7 acres is also planned in the county, including a 2.21-acre park and a 14.3-acre business park, east of the city of Merced in southeastern Merced County. At Volta Road and Ingomar Grade, a minor subdivision (26.9 acres) to be sold for future industrial and commercial development and construction of a batch plant, bulk cement storage silos, portable cement silo, storage and fuel tanks, casting area, pump house, truck wash area, related collection facilities, and parking area, is in the pipeline. A new four-lane construction/extension is planned for Memorial Drive between Santa Ana and Flynn Road, a new four-lane expressway bypassing the city of Los Banos is planned from west of Volta Road to SR 165 south of Henry Miller Road, and freeway conversion from the Santa Clara County line to the Madera County line is planned to include three new interchanges at West SR 152, SR 165, and East SR 152.

In the San Joaquin Valley Subsection, a large recreation-oriented residential community is planned southeast of the I-5/SR 152 interchange. The Fox Hills Community Specific Plan, approved in 2006, includes a 402-lot single-family residential development, an 18-hole championship golf course and clubhouse, restaurant, parks, trails, wildlife conservation, and utility infrastructure improvements (Merced County Planning and Community Development Department 2006). Planned development in the Santa Nella area includes the Villages at Laguna San Luis, a 6,200-acre mixed-use development that has been approved but not yet constructed west of I-5 along SR 152 and SR 33 in western Merced County. The Santa Nella Community Specific Plan was adopted by Merced County in May 2000 and development is ongoing within the Specific Plan area. The Specific Plan proposes 5,181 low-density residential units, 74 golf course residential

units, 878 medium-density residential units (of which 20 acres may be high density—400 dwelling units/acre maximum), and 350 existing residential units; 2,160,600 square feet of commercial retail uses; 396,396 square feet of office commercial units; 3,027,418 square feet of industrial uses; and expansion of the existing golf course. The Los Banos General Plan 2030 covers a planning area extending south from Henry Miller Road, east approximately 2.7 miles from just west of the Ingomar Grade; at that point the planning area is farther south and does not abut Henry Miller Road. Based on average buildout densities for new residential uses, the general plan accommodates 17,000 new households at an average household size of 3.44 through infill development as well as new development. In total, general plan buildout would result in approximately 27,000 households and an additional 41,900 jobs in Los Banos. Most areas that are planned for new development would be residential. Infill development is expected to continue within city limits; however, new residential, commercial, and industrial development is also anticipated to occur farther from the downtown core within the Urban Growth Boundary, although not abutting Henry Miller Road.

2.6.1.3 Planned Highway Improvements

The highway component of the No Project Alternative includes the planned efforts of Caltrans and the three study area counties (Santa Clara, San Benito, and Merced) to address the anticipated growth in vehicle miles traveled (VMT) and resulting congestion on the roadway system. VMT is expected to increase significantly in all counties by 2040 (Caltrans 2016).

Analysis of the No Project Alternative considers the funded and programmed improvements on the intercity highway network based on financially constrained regional transportation plans developed by regional transportation planning agencies. SR 237 express lanes and Central, Montague, and San Tomas Expressway improvements are planned in Santa Clara County. The improvements in Santa Clara County primarily entail construction of an express lane network on the highway system—individual interchange upgrades, conversion of HOV lanes to express lanes, and construction of new express lanes (Table 2-5). These improvements will not cumulatively add substantial capacity to the existing highway system, but they will provide enhanced efficiency of existing highways. Plans have been approved (but not yet funded) to construct a new alignment of SR 152 from SR 156 to US 101 in Santa Clara and San Benito Counties. Other Merced County improvements provide additional capacity in the Los Banos area.

Table 2-5 shows planned highway, pedestrian, parking, and bicycle improvements in the three-county area.

Table 2-5 Planned Transportation Improvements

Project	Type of Project
Santa Clara County/San Jose	
SR 85 HOV conversion, South San Jose to Mountain View	Conversion of HOV lanes to express lanes
SR 87 HOV conversion, SR 85 to US 101	Conversion of HOV lanes to express lanes with interchange modifications
US 101 express lane conversion, San Mateo/ Santa Clara County Line to SR 25	Conversion of HOV lanes to express lanes and construction of express lanes with interchange modifications
SR 237 express lanes, North First St to Mathilda Ave	Conversion of HOV lanes to express lanes and construction of express lanes with interchange modifications
I-280 express lanes, Leland Ave to US 101	Conversion of HOV lanes to express lanes and construction of express lanes with interchange modifications
I-680 express lanes, Alameda County line to US 101	Conversion of HOV lanes to express lanes and construction of express lanes with interchange modifications

Project	Type of Project
I-880 express lanes, Alameda County line to US 101	Conversion of HOV lanes to express lanes and construction of express lanes with interchange modifications
Widen Coleman Ave from four to six lanes from I-880 to Taylor St	Road widening
Diridon Area parking and multimodal improvements	Parking and transit improvements
Morgan Hill	
Widen southbound US 101 off-ramp at Cochrane Rd from 2 to 3 lanes	Road widening
Hale Ave extension, Main St to Dunne Ave	Road extension
US 101/Tennant Ave interchange improvements	Interchange expansion and reconfiguration and road widening
US 101 widening, Cochrane Rd to SR 25	Road widening to add an express lane in each direction
Gilroy	
Construct interchange at US 101 and Buena Vista Ave	Construction of new interchange
US 101 widening, Monterey Rd to SR 25, and US 101/SR 25 interchange construction	Road widening and construction of a new interchange
SR 152 widening from SR 156 to US 101	Road widening
Improve ramp/intersection on SR 152 eastbound at Frazier Lake Rd	Road reconfiguration
Luchessa Ave, Monterey to Jamieson	Road extension
Luchessa Ave, Jamieson to Rossi	Road extension
Las Animas Ave overcrossing at US 101	Construction of new overcrossing
Merced County	
SR 152: Pacheco Pass median barrier	Demolition and construction of bridge
Pacheco Pass median barrier	Construct median barrier
SR 152	Road widening to four-lane arterial through Los Banos
SR 152 bypass	Bypass over the north of Los Banos
Pioneer Rd	Construct as four-lane arterial to Ortigalita Rd, Los Banos
Volta Road	Construct grade-separated crossing with SR 152
Ingomar Grade Rd/H St	Widen to four-lane arterial
Mercy Springs Road SR 165	Widen to four-lane arterial

Sources: City of Los Banos 2009; VTA 2014

2.6.1.4 Planned Aviation Improvements

There are five airports in the project vicinity.

Mineta San Jose International Airport

The Norman Y. Mineta San Jose International Airport (SJC) is served by 12 commercial airlines with approximately 130 daily departures to 30 nonstop destinations. In November 2005, the San

Jose City Council approved a comprehensive plan for replacing and upgrading the terminal facilities at SJC. The Terminal Area Improvement Program (TAIP) is planned in two phases. Phase 1 was completed in 2010. Phase 2, expansion to add 12 more aircraft gates, would begin when the airport reaches specific levels of passenger activity or flights in the future (City of San Jose 2015).

The first phase of the TAIP included the comprehensive modernization of the airport. Elements included a new Terminal B and Concourse, upgrades for Terminal A, expanded restaurant and retail concessions, expanded roadway capacity, a convenient consolidated rental car center and public parking garage, and public art. Construction of Terminal B and the new Terminal B Concourse began in 2004 as the first major element of the new airport facilities. Located between Terminal A and Terminal B, the new concourse has 12 aircraft gates, waiting lounges, and new shops and restaurants. Southwest Airlines activated the first six gates in the new concourse for interim service in July 2009. The remainder of the concourse opened with the completion of Terminal B facilities in June 2010.

Phase 2 includes the second half of Terminal B with a South Concourse mirroring the North Concourse, adding 12 new aircraft gates. This addition would bring the total number of gates to the 40 allowed under the 2011 Airport Master Plan Update to serve 17 million annual passengers (City of San Jose 2011).

Merced Regional Airport

The Merced Regional Airport is a general aviation airport. It offers facilities for general aviation aircraft, car rental agencies, a restaurant, Gateway Air Center for private aircraft, offices for government agencies, concessionaires, and corporate hangars. The Regional Airport Authority prepared a Capital Improvement Plan for 2015–2020 (Regional Airport Authority 2014), identifying plans for pavement assessments and remarking. No major aviation improvements are planned at this time.

San Martin Airport (Santa Clara County)

This is a general aviation facility in San Martin, adjacent to US 101. It is owned by Santa Clara County and has one 3,100-foot runway. Planned improvements included in the Santa Clara County *Airports Business Plan* (County of Santa Clara 2018) are constructing an access road between the transient apron and the County-owned hangar area, installing a backup generator for the runway lighting and fire protection systems, and acquiring property at the south end of the airport for safety zones for the proposed runway extension.

Frazier Lake Airpark

Frazier Lake Airpark is a privately owned airport 8 miles northwest of Hollister. It has one 2,500-foot turf runway and one 3,000-foot water runway. No major improvements are planned.

Los Banos Municipal Airport

The Los Banos Municipal Airport is a general aviation airport used primarily by private aircraft. No major improvements are planned.

2.6.1.5 Planned Intercity Transit Improvements

The 2040 No Project Alternative transit service levels include all planned bus and rail service upgrades to accommodate regional growth, including Caltrain electrification between San Francisco and Tamien Station (i.e., PCEP), new BART service at Diridon Station, as well as new BRT service at San Jose Diridon Station and express bus service from Gilroy Station to Hollister and Monterey County. All of these services have generally been planned assuming the potential for future integration with HSR, but they would provide increased transit service levels without the introduction of HSR.

Conventional Passenger Rail

Several conventional passenger rail systems serve portions of the project extent. BART does not currently serve Santa Clara County, but plans an extension of service from Warm Springs in Fremont initially to a Berryessa Station in San Jose beginning in 2019, and ultimately through downtown San Jose to Santa Clara by 2026. A stop would be provided at the San Jose Diridon Station.

Amtrak—Amtrak provides intercity passenger rail service in California on four principal corridors covering more than 1,300 linear route miles and spanning most of the state. The existing passenger rail network in the San Jose to Merced corridor includes portions of three of these corridors: the Coast Starlight follows the UPRR coast route between San Jose and Gilroy; the San Joaquin route follows the BNSF Railway (BNSF) corridor in Madera and Merced Counties; and the Capitol Corridor, which terminates in San Jose, provides service north to Oakland and eventually to Sacramento and Auburn.

Caltrain—The PCJPB Caltrain service provides regional service between San Francisco and San Jose, with three peak hour/peak direction weekday trips extending to Gilroy. In 2018, there were 46 daily weekday roundtrips between San Francisco and San Jose Diridon Station, with 17 roundtrips extending to Tamien Station and three to Gilroy (Caltrain 2019). Stations served in the study area between Diridon San Jose and Gilroy Stations are Tamien, Capitol, Blossom Hill, Morgan Hill, and San Martin. The PCJPB is a joint exercise of powers agency formed by means of a Joint Powers Agreement among three entities: the City and County of San Francisco, the San Mateo County Transit District, and the VTA. The San Mateo County Transit District is the Managing Agency of the PCJPB pursuant to the Joint Powers Agreement. The PCJPB owns the rail right-of-way from Tamien Station (CP Lick) to San Francisco 4th and King Station, sharing that ownership within San Mateo County with the San Mateo County Transit District. For its operations south of Tamien, Caltrain uses trackage rights it holds over the UPRR-owned right-of-way and stations owned by VTA at Capitol, Blossom Hill, Morgan Hill, San Martin, and Gilroy. The PCJPB has trackage rights agreements in place with the UPRR regarding freight operations over the PCJPB-owned right-of-way from Tamien Station to San Francisco. On a portion of that right-of-way, between CP Coast (near Santa Clara) and Tamien/CP Lick, UPRR owns its own track, known as Main Track 1. PCJPB also has agreements in place for tenant railroads Altamont Corridor Express (ACE), Capitol Corridor, and Amtrak. These agreements govern their usage of the PCJPB-owned tracks and stations.

ACE—The ACE provides four daily round-trip trains from Stockton to San Jose Diridon Station via Tracy and Livermore, with intermediate stops. ACE is working with the Authority to study an enhanced regional rail service between Stockton, Modesto, and San Jose and plans to expand service to 6 round trips in the short term and 10 round trips in the long term.

VTA—The VTA provides bus, light rail, and paratransit within Santa Clara County. The VTA operates a light rail system (Line 901, the Alum Rock—Santa Teresa line) serving San Jose and surrounding suburban areas south and east of San Jose Diridon Station. The VTA also manages BART Silicon Valley extending from Fremont through the cities of Milpitas, San Jose, and Santa Clara (VTA 2016a). The program's first phase would connect the Warm Springs BART Station in Fremont to the Berryessa BART Station in San Jose. The second phase would construct a subway tunnel from the Berryessa Station through downtown San Jose and the San Jose Diridon Station, terminating service at the Santa Clara Caltrain Station and continuing to a maintenance facility at the Newhall Maintenance Yard (VTA 2016b). The project would connect with BART at the San Jose Diridon Station.

Various passenger rail improvements that would affect service in the San Jose to Merced corridor are planned through 2040 (Table 2-6). Planned improvements include track and signal improvements, bridges, maintenance and layover facilities, and station improvements.

Table 2-6 Planned Passenger Rail Projects (Forecast Year 2040)

Project	Jurisdiction	Description
Peninsula Corridor Electrification Project	Multicounty	Caltrain service improvements (six peak trains, electrification, CBOSS, PTC)
Transbay Center/Caltrain DTX Phase 2	Multicounty	2019 opening year (not funded)
BART Extension to Berryessa	Santa Clara	2019 opening year
BART Extension to Santa Clara (Phase 2)	Santa Clara	2025/26 opening year
Mineta San Jose APM Connector	Santa Clara	
Capitol Expressway Light Rail Project	Santa Clara	2022 opening year
Caltrain South Terminal Project, Phase II	Santa Clara	2020 completion
Tasman Express Long-T Alum Rock to MTV	Santa Clara	2019 opening year
Gilroy station improvements	Santa Clara	
Capitol Corridor Extension to Salinas	Multicounty	2020 opening year
ACE*forward*	Multicounty	2023 opening year
Caltrain systemwide station access improvements	Multicounty	Initiated in 2015
South County track improvements; second mainline track and crossing improvements (Coyote to Gilroy)	Santa Clara	2020 opening year
At-grade crossing improvements	Multicounty	2020 completion year

Source: Caltrans 2013b; TAMC 2014; VTA 2017a
CBOSS = communications-based overlay signal system
DTX = Downtown Extension
PTC = positive train control

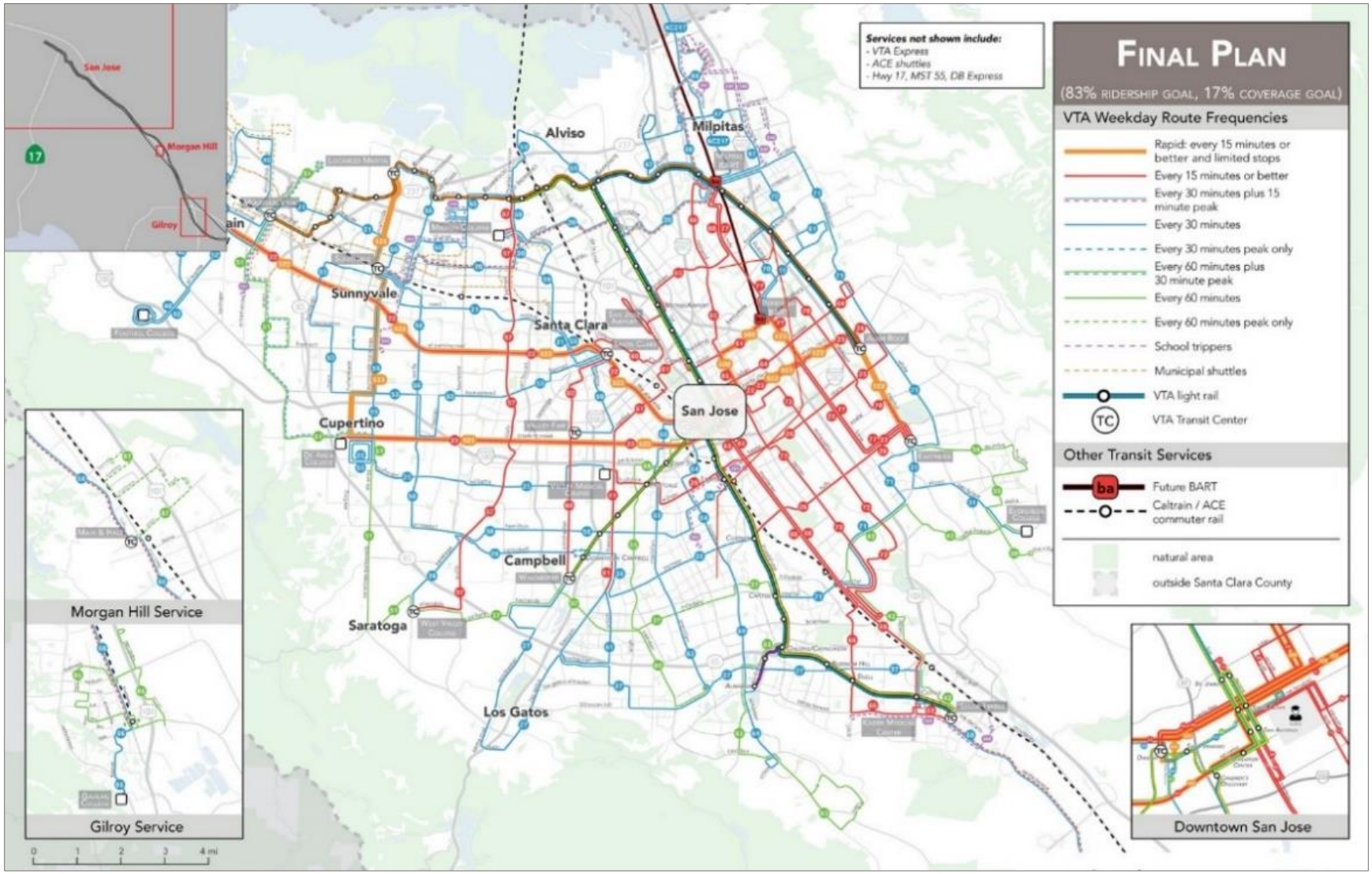
Intercity Passenger Bus Service

In the project vicinity, VTA buses provide transit connectivity between San Jose and neighboring communities (Figure 2-31). Merced County Transit provides commuter service between Merced and Los Banos, approximately 2 miles south of the HSR alignment on Henry Miller Road (Figure 2-32). There are no direct transit connections linking either San Jose or Gilroy to Merced. Traveling from Merced to San Jose currently requires using a combination of transit modes, including the Amtrak San Joaquin line, BART, bus, and Caltrain, to reach San Jose, a journey of approximately 5 hours. By comparison, auto travel time between San Jose and Merced is approximately 2 hours.

Gilroy Transit Center provides transit connectivity among VTA bus lines, San Benito County Transit shuttles, Monterey-Salinas Transit buses, Amtrak Thruway buses, and Caltrain commuter trains.

Two BRT projects are planned in Santa Clara County in the vicinity of the HSR. The El Camino Real BRT, intended to provide service between Palo Alto Transit Center and downtown San Jose, is currently on hold; the Stevens Creek BRT (Rapid 523) is expected to open in fall 2019 providing service between the Berryessa BART station and De Anza College near Cupertino (VTA 2018a).

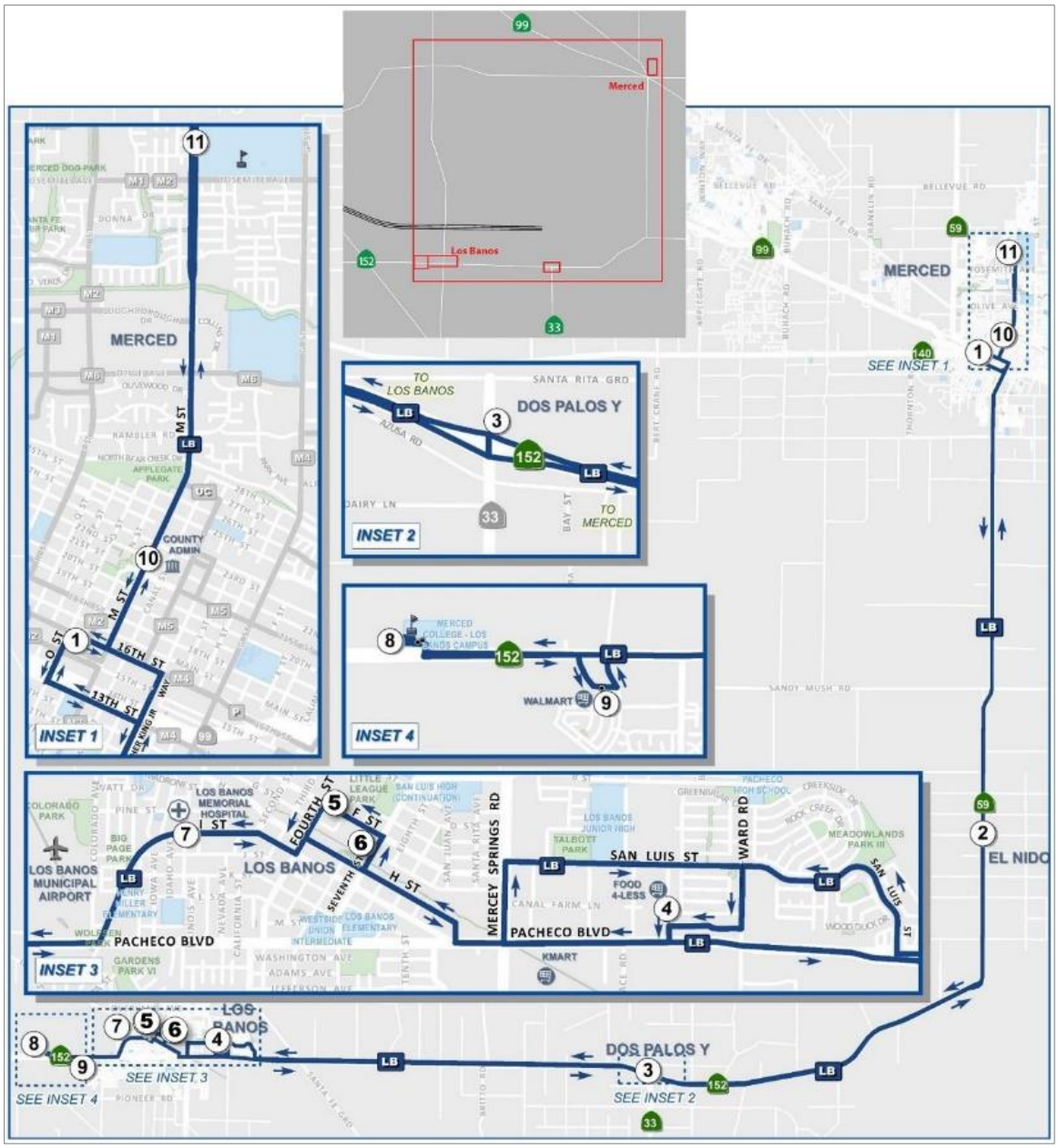
The VTA operates an active fleet of 493 buses on 73 routes throughout the urbanized area of Santa Clara County. Total ridership in fiscal year 2016 was 32,195,504, with an average weekday ridership of 104,009 (VTA 2016b).



Source: VTA 2017b

AUGUST 2017

Figure 2-31 VTA's FY18-19 Transit Service Plan Proposed Service in San Jose, Morgan Hill, and Gilroy



Source: Transit Joint Powers Authority for Merced County 2017 AUGUST 2017

Figure 2-32 Weekday Commuter Service between Merced and Los Banos

The VTA operates 10 bus lines at San Jose Diridon Station and serves the downtown Gilroy Caltrain station with four regular bus lines. The VTA also operates its light rail network and shuttle network and cosponsors three intercounty bus services through cooperative arrangements with other transit systems.

Greyhound provides daily service from the San Jose Diridon Station as well as service from the Caltrain station in downtown Gilroy.

The VTA plans to consolidate intercity bus service with an 83 percent ridership goal and a 17 percent coverage goal. Implementation of the 2018/2019 plan would coincide with opening of the connection between BART's Berryessa and Diridon stations in fall 2019 (VTA 2017c). Continued

intercity bus service is an element of the No Project Alternative, but it represents only a small portion of the greater intercity travel market.

2.6.1.6 Planned Freight Rail Improvements

The San Jose to Gilroy corridor and the Port of Oakland through the Altamont Pass to Sacramento are the southern portions of a northern California goods movement mega-region. This mega-region serves 19 counties and 147 cities, employs more than 1.7 million workers, and contributes more than $10 billion to the mega-region's economic output. The mega-region can be defined as the economically and geographically linked regions of the Bay Area, Sacramento, the northern San Joaquin Valley, and the Monterey Bay Area. Alameda County—and the Port of Oakland especially—is the heart of the Bay Area's freight activity. In northern California, the Martinez Subdivision, Feather River Canyon, and Donner Pass routes serve the Port of Oakland and Port of Stockton. Freight rail traffic in the project extent is expected to increase at a compound annual growth rate of 3.5 percent to 2040 because of increased intermodal rail shipments (e.g., shipping containers that can be single- or double-stacked on railcars, stacked in a container ship, and placed on a truck trailer chassis) coming from the Port of Oakland (Caltrans 2014).

In Alameda County, UPRR owns and runs trains on multiple tracks, whereas BNSF operates on one of UPRR's mainlines between Oakland and the county boundary. UPRR's northern route into and out of the Port of Oakland uses the Martinez subdivision traversing Emeryville and Richmond. This is the busiest rail line in northern California as it mixes UPRR trains in and out of the Port of Oakland, BNSF trains, San Joaquin trains, and Capitol Corridor trains. The Coast Line is UPRR's southern route into and out of the Port of Oakland toward San Jose, supporting a similar mix of trains and traffic.

UPRR operates the freight rail system in the Santa Clara to Madera corridor (via Niles Canyon and the Altamont Pass), while BNSF provides freight movement in and through Merced County. In Santa Clara County, freight trains operate daily on the UPRR Coast Line between San Jose and Gilroy; the Coast Line is also traveled by Caltrain, Amtrak, and ACE passenger services. The current combined freight and passenger train volume along this shared corridor is 11 to 25 trains per day, predominantly Caltrain passenger service (Caltrans 2013a). UPRR freight train operations do not follow a set schedule, varying in response to freight customer needs and activity. In Merced County, rail freight service is used by several industrial/manufacturing and agricultural companies, with the largest users in the cities of Merced, Atwater, and Los Banos. BNSF is the primary owner of the railroad right-of-way used by freight and Amtrak San Joaquin trains along the SR 99 corridor. BNSF's ongoing track maintenance program in California involves surfacing and/or undercutting about 2,300 miles of track, replacing more than 100 miles of rail and 300,000 ties, and upgrading signals for PTC implementation.

2.6.1.7 Planned Port Improvements

There are no existing ports in the project vicinity.

2.6.2 San Jose to Central Valley Wye Project Alternatives

This section presents detailed descriptions of the four end-to-end project alternatives, identified as Alternative 1, Alternative 2, Alternative 3, and Alternative 4. Since the four alternatives contain many common elements, these are described briefly first, followed by a more detailed description of each alternative by subsection. Volume 3 of this Final EIR/EIS contains the preliminary design drawings. Figure 2-1 illustrates the four project alternatives.

2.6.2.1 Preferred Alternative (CEQA Proposed Project)

On September 17, 2019, the Authority Board of Directors reviewed a staff recommendation on the Preferred Alternative and a summary of key identified outreach concerns. The Board confirmed that Alternative 4 was the Preferred Alternative for purposes of the Draft EIR/EIS and serves as the CEQA proposed project for purposes of CEQA Guidelines Section 15124.

The process for considering and the rationale for selecting the Preferred Alternative are presented in Chapter 8, Preferred Alternative, of this Final EIR/EIS. The Authority identified

Alternative 4, with the inclusion of the Diridon design variant (DDV) and the tunnel design variant (TDV), as the Preferred Alternative in this Final EIR/EIS.

2.6.2.2 Summary of Design Features

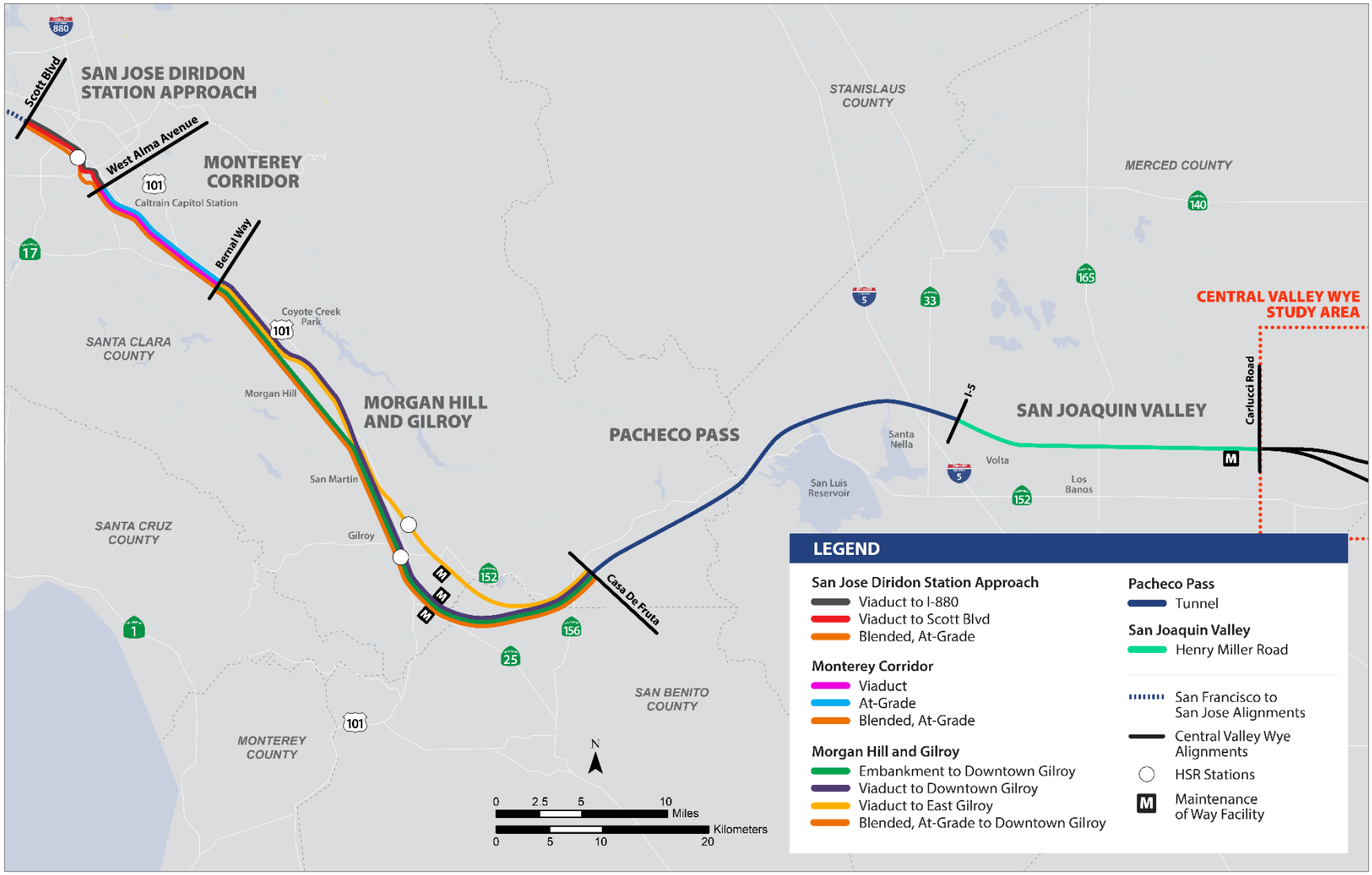
Subsections and Design Options

The project is an approximately 90-mile portion of the 145-mile-long Project Section. It comprises mostly dedicated HSR system infrastructure, HSR station locations at San Jose Diridon and Gilroy, an MOWF in the Gilroy area, and an MOWS near Turner Island Road in the Central Valley. HSR stations at San Jose Diridon and Gilroy would support TOD, provide an interface with regional and local mass transit services, and provide connectivity to the South Bay and Central Valley highway network.[8] The project begins at Scott Boulevard in Santa Clara. The HSR infrastructure and operations transition from the blended system between San Francisco and Santa Clara to a fully dedicated system north of the San Jose Diridon Station, either at Scott Boulevard in Santa Clara or near I-880; or, in the case of Alternative 4, the blended system extends to downtown Gilroy. The project continues south and east from Gilroy, continuing east through the Pacheco Pass to the Central Valley to its end at Carlucci Road, the western limit of the Central Valley Wye. The project comprises the following five subsections as illustrated on Figure 2-33:

- **San Jose Diridon Station Approach**—Extends approximately 6 miles from north of San Jose Diridon at Scott Boulevard in Santa Clara to West Alma Avenue in San Jose. This subsection includes San Jose Diridon Station and overlaps the southern portion of the San Francisco to San Jose Project Section.
- **Monterey Corridor**—Extends approximately 9 miles from West Alma Avenue to Bernal Way in the community of South San Jose. This subsection is entirely within the city of San Jose.
- **Morgan Hill and Gilroy**—Extends approximately 30 to 32 miles from Bernal Way in the community of South San Jose to Casa de Fruta Parkway/SR 152 in the community of Casa de Fruta in Santa Clara County.
- **Pacheco Pass**—Extends approximately 25 miles from Casa de Fruta Parkway/SR 152 to I-5 in Merced County.
- **San Joaquin Valley**—Extends approximately 18 miles from I-5 to Carlucci Road in unincorporated Merced County.

The Authority has developed four end-to-end alternatives for the project: Alternative 1, Alternative 2, Alternative 3, and Alternative 4. Table 2-7 shows the distinguishing features of the design options for each alternative by subsection; Figure 2-34 through Figure 2-38 illustrate the features of the four alternatives for each subsection. Table 2-8 shows the details of each design option by alternative.

[8] *South Bay* refers to Santa Clara County.



Source: Authority 2019a

JUNE 2019

Figure 2-33 Overview Map of Design Options by Subsection

Table 2-7 San Jose to Central Valley Wye Design Options by Subsection

Subsection/Design Option	Alternative 1	Alternative 2	Alternative 3	Alternative 4[1]
San Jose Diridon Station Approach				
Viaduct to Scott Blvd	–	X	X	–
Viaduct to I-880	X	–	–	–
Blended, at-grade	–	–	–	X
Monterey Corridor				
Viaduct	X	–	X	–
At-grade	–	X	–	
Blended, at-grade	–	–	–	X
Morgan Hill and Gilroy				
Embankment to downtown Gilroy	–	X	–	–
Viaduct to downtown Gilroy	X	–	–	–
Viaduct to east Gilroy	–	–	X	–
Blended, at-grade[1]	–	–	–	X
Pacheco Pass				
Tunnel	X	X	X	X
San Joaquin Valley				
Henry Miller Rd	X	X	X	X

Source: Authority 2019a
X = present; – = absent; 1 Alternative 4 is blended, at-grade to the Downtown Gilroy station.
[1]The Authority has identified Alternative 4 as the preferred alternative as described in Chapter 8, Preferred Alternative.

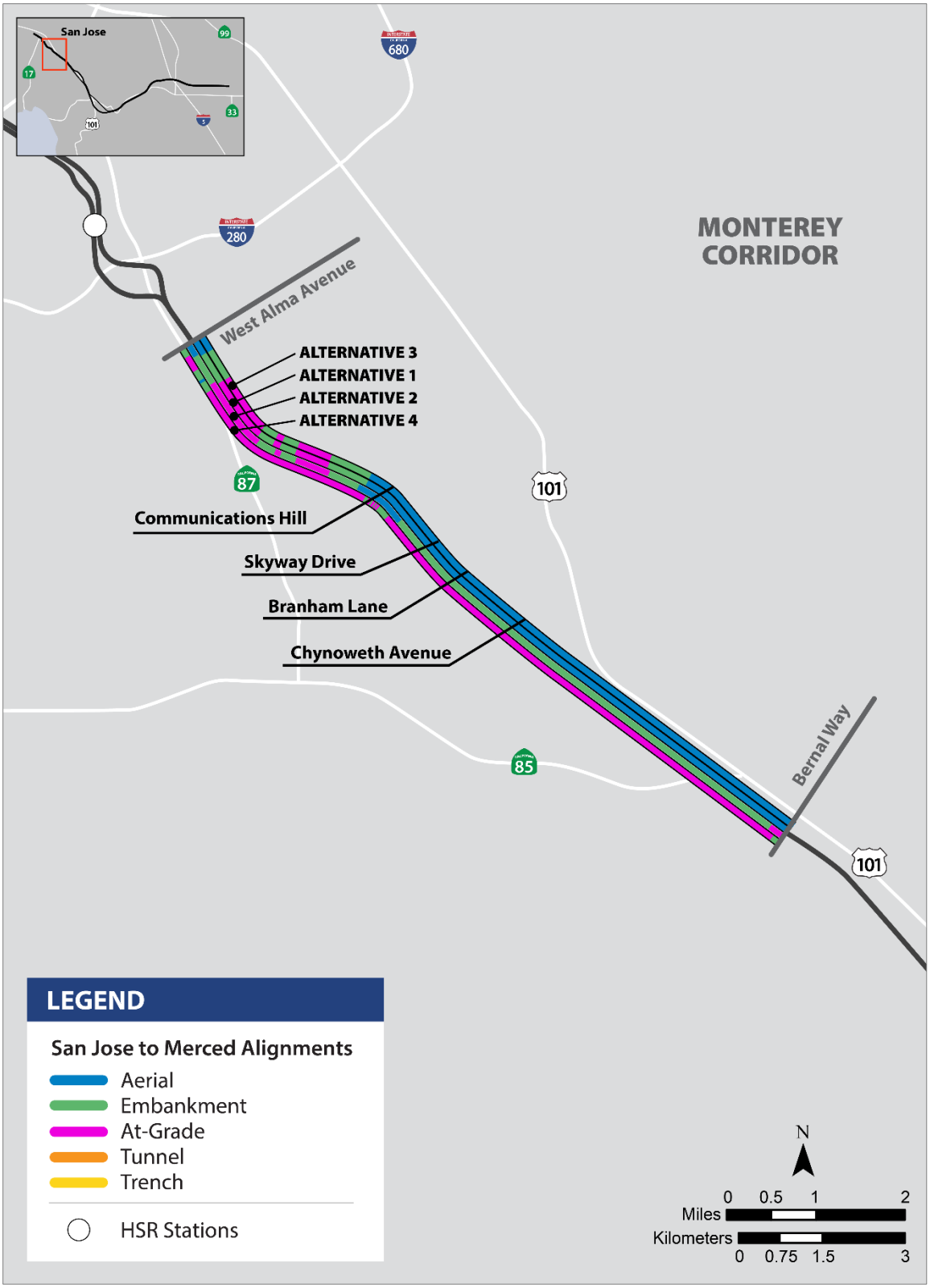
The Authority has included two design variants under Alternative 2 to address different configurations of Monterey Road and access to and from San Jose Fire Station #18; referred to as the Skyway Drive variants. The Authority has developed two design variants intended to optimize train speed: referred to as the Diridon design variant (DDV) and tunnel design variant (TDV). The first (DDV) is located north and south of Diridon Station and at the station platforms and, if adopted, would apply only to Alternative 4. The second (TDV) is located at the two tunnels east of Gilroy and through the Pacheco Pass and would apply to all four alternatives. The Alternative 4 design variants were presented in Section 3.20 of the Draft EIR/EIS. The content from Section 3.20 has been fully integrated into the relevant resource sections in this Final EIR/EIS. The differences in impacts associated with both sets of design variants are shown in parentheses.

The Authority's 2016 and 2018 Business Plans confirmed the phased implementation of the HSR system in California (Authority 2016c, 2018). The Authority's initial operation would be Valley-to-Valley service in 2029[9], operating between San Francisco and Bakersfield. This service could also branch to Merced from the Bay Area (Valley-to-Valley Extension). Full Phase 1 service is planned for 2033, with operations extending from San Francisco to Los Angeles and Anaheim in Southern California.

9 The Authority's 2020 Business Plan assumes a similar phased implementation strategy for Phase 1 of the HSR system, although the Valley-to-Valley service operational date was refined from 2029 to 2031 (Authority 2021).

Source: Authority 2019a JUNE 2019
CEMOF = Centralized Equipment Maintenance and Operation Facility

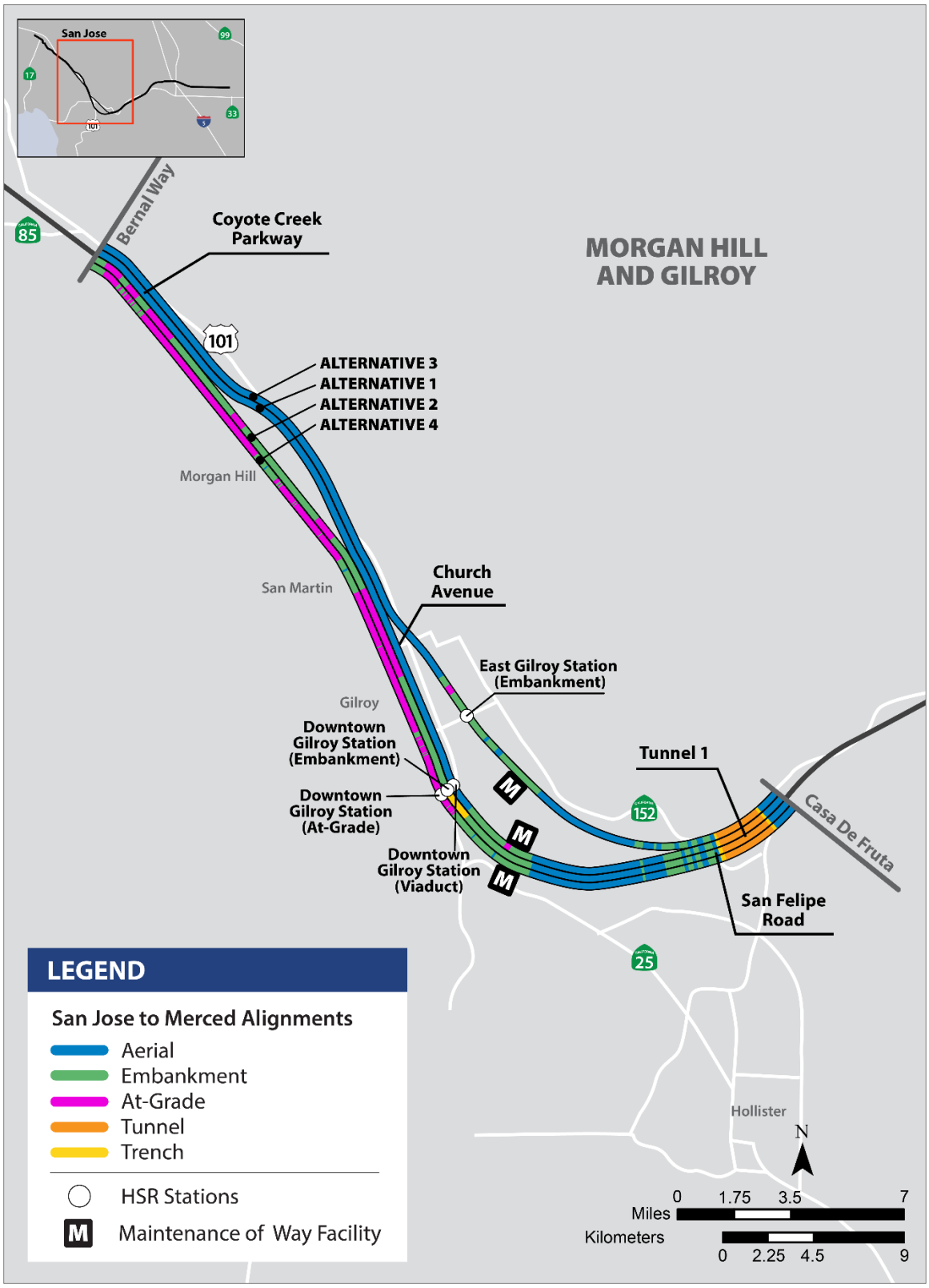
Figure 2-34 San Jose Diridon Station Approach Subsection



Source: Authority 2019a

JUNE 2019

Figure 2-35 Monterey Corridor Subsection



Source: Authority 2019a

JUNE 2019

Figure 2-36 Morgan Hill and Gilroy Subsection

Source: Authority 2019a

JUNE 2019

Figure 2-37 Pacheco Pass Subsection

Source: Authority 2019a

JUNE 2019

Figure 2-38 San Joaquin Valley Subsection

Table 2-8 Design Features of the HSR Build Alternatives

Subsection	Design Option	Total Length (linear miles)	Aerial (linear miles)	Embankment and At-Grade (linear miles)	Trench (linear miles)	Underground Easement (linear miles)	Number of Straddle Bents	Number of Railroad Crossings	Number of Water Crossings	Number of At-Grade Roadway Crossings	Number of Roadway Closures[1]	Number of Roadway Grade Separations
Alternative 1												
San Jose Diridon Station Approach	Viaduct to I-880	6.0	3.1	2.9	0.0	0.0	25	8	2	0	4	1
Monterey Corridor	Viaduct	8.8	6.4	2.4	0.0	0.0	5	1	0	0	0	0
Morgan Hill and Gilroy	Viaduct to downtown Gilroy	32.4	26.6	4	0.2	1.6	6	2	32	0	6	0
Pacheco Pass	Tunnel	24.5	4.0	4.9	2.1	13.5	0	0	51	0	0	0
San Joaquin Valley	Henry Miller Rd	17.5	5.3	12.2	0.0	0.0	0	1	69	0	8	5
TOTALS		88.9	45.4	26.2	2.3	15.0	36	12	154	0	18	6
Alternative 2												
San Jose Diridon Station Approach	Viaduct to Scott Blvd	5.9	5.3	0.6	0.0	0.0	44	11	2	0	4	2
Monterey Corridor	At-Grade	8.7	0.9	7.9	0.0	0.0	3	1	0	0	2	3
Morgan Hill and Gilroy	Embankment to downtown Gilroy	32.0	5.3	24.0	1.1	1.6	0	1	32	0	15	22
Pacheco Pass	Tunnel	24.4	4.0	4.9	2.1	13.5	0	0	51	0	0	0

Subsection	Design Option	Total Length (linear miles)	Aerial (linear miles)	Embankment and At-Grade (linear miles)	Trench (linear miles)	Underground Easement (linear miles)	Number of Straddle Bents	Number of Railroad Crossings	Number of Water Crossings	Number of At-Grade Roadway Crossings	Number of Roadway Closures[1]	Number of Roadway Grade Separations
San Joaquin Valley	Henry Miller Rd	17.6	5.3	12.2	0.0	0.0	0	1	69	0	8	5
TOTALS		88.6	20.9	49.5	3.2	15.0	47	14	154	0	29	32
Alternative 3												
San Jose Station Diridon Approach	Viaduct to Scott Blvd	5.9	5.3	0.6	0.0	0.0	44	11	2	0	4	2
Monterey Corridor	Viaduct	8.7	6.4	2.4	0.0	0.0	5	1	0	0	0	0
Morgan Hill and Gilroy	Viaduct to east Gilroy	30.8	22.2	6.7	0.3	1.6	6	0	27	0	5	3
Pacheco Pass	Tunnel	24.4	4.0	4.9	2.1	13.5	0	0	51	0	0	0
San Joaquin Valley	Henry Miller Rd	17.6	5.3	12.2	0.0	0.0	0	1	69	0	8	5
TOTALS		87.4	43.2	26.7	2.4	15.0	55	13	149	0	17	10
Alternative 4												
San Jose Station Diridon Approach	Blended, At Grade	6.0	0.3	5.6	0.0	0.0	0	2	2	2	0	1
Monterey Corridor	Blended, At Grade	8.8	0.03	8.7	0.0	0.0	0	0	0	3	0	0
Morgan Hill and Gilroy	Blended, At Grade	32.0	5.5	24.7	0.2	1.6	0	1	25	24	7	0
Pacheco Pass	Tunnel	24.4	4.0	4.9	2.1	13.5	0	0	51	0	0	0

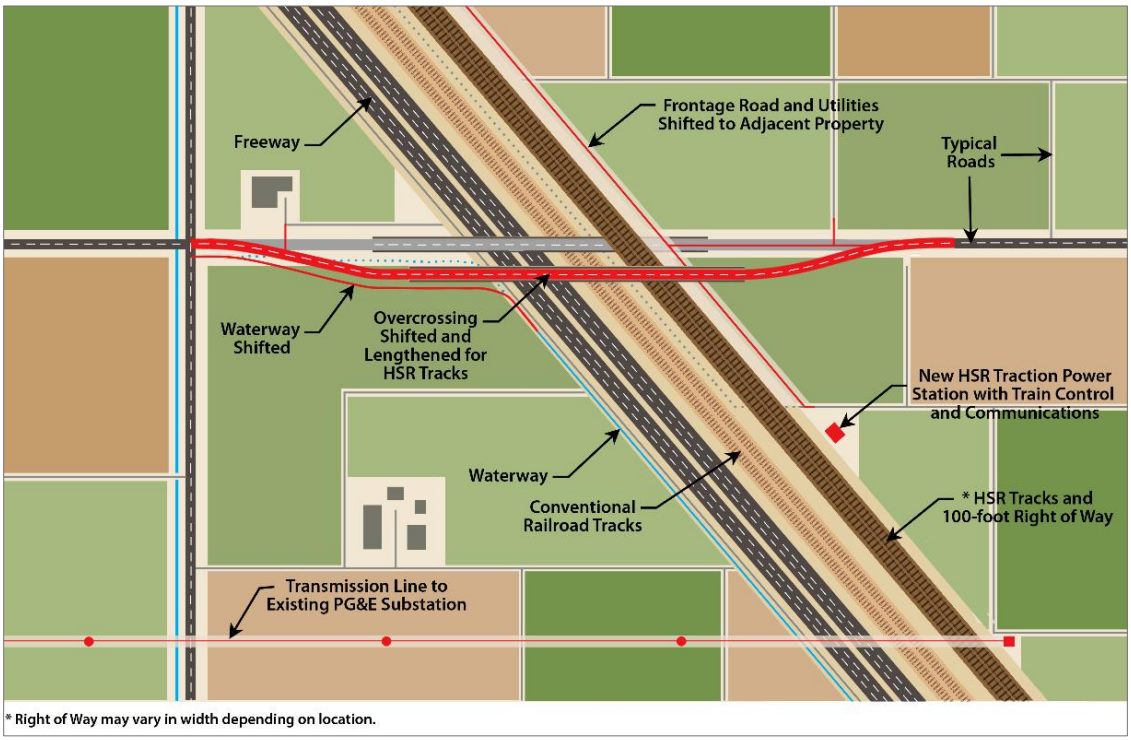
Subsection	Design	Total Length (linear miles)	Aerial (linear miles)	Embankment and At-Grade (linear miles)	Trench (linear miles)	Underground Easement (linear miles)	Number of Straddle Bents	Number of Railroad Crossings	Number of Water Crossings	Number of At-Grade Roadway Crossings	Number of Roadway Closures[1]	Number of Roadway Grade Separations
San Joaquin Valley	Henry Miller Rd	17.6	5.3	12.2	0.0	0.0	0	1	69	0	8	5
TOTALS		88.7	15.2	56.2	2.3	15.0	0	4	147	29	15	6

Source: Authority 2019a
[1] Roadway closures comprise HSR crossings of roads, highways, and ramps, but they do not include left turn lane closures or road modifications such as realignments and merges.
Some numbers may not total due to rounding.

Requirements Common to All Alternatives

Infrastructure Considerations

Because all four alternatives follow the same general corridor, they must address many of the same concerns regarding local infrastructure. The common requirements to address these concerns are as follows (Figure 2-39):


Freeway
Frontage Road and Utilities Shifted to Adjacent Property
Typical Roads
Waterway Shifted
Overcrossing Shifted and Lengthened for HSR Tracks
New HSR Traction Power Station with Train Control and Communications
Waterway
Conventional Railroad Tracks
* HSR Tracks and 100-foot Right of Way
Transmission Line to Existing PG&E Substation
* Right of Way may vary in width depending on location.

Source: Authority and FRA 2017a MAY 2017

Figure 2-39 Representative HSR Infrastructure Considerations

- **Frontage road and local roadway crossings**—Where the corridor passes through rural regions, it would affect existing local frontage roads used by small communities and farm operations. Where these frontage roads parallel the HSR alignment, they would be shifted and reconstructed to maintain their function. Where roads are perpendicular to the proposed HSR, over- or undercrossings are planned approximately every 2 miles. Between these crossings, some roads may be closed. These modifications and closures are identified on project maps and in Appendix 2-A. Additionally, the blended, at-grade system would implement continuous access restriction fencing of the railroad right-of-way, four-quadrant gates extending across all lanes of travel and crosswalks, median separators to channelize and regulate paths of vehicular travel, pedestrian crossing gates, and wildlife entry deterrents in heavy wildlife corridors.
- **Irrigation and drainage facilities**—The project would affect existing drainage and irrigation facilities. Depending on the severity of the impact, existing facilities would be modified, improved, or replaced as necessary to maintain existing drainage and irrigation functions, allow operations and maintenance access for facility owners, and support HSR drainage requirements.

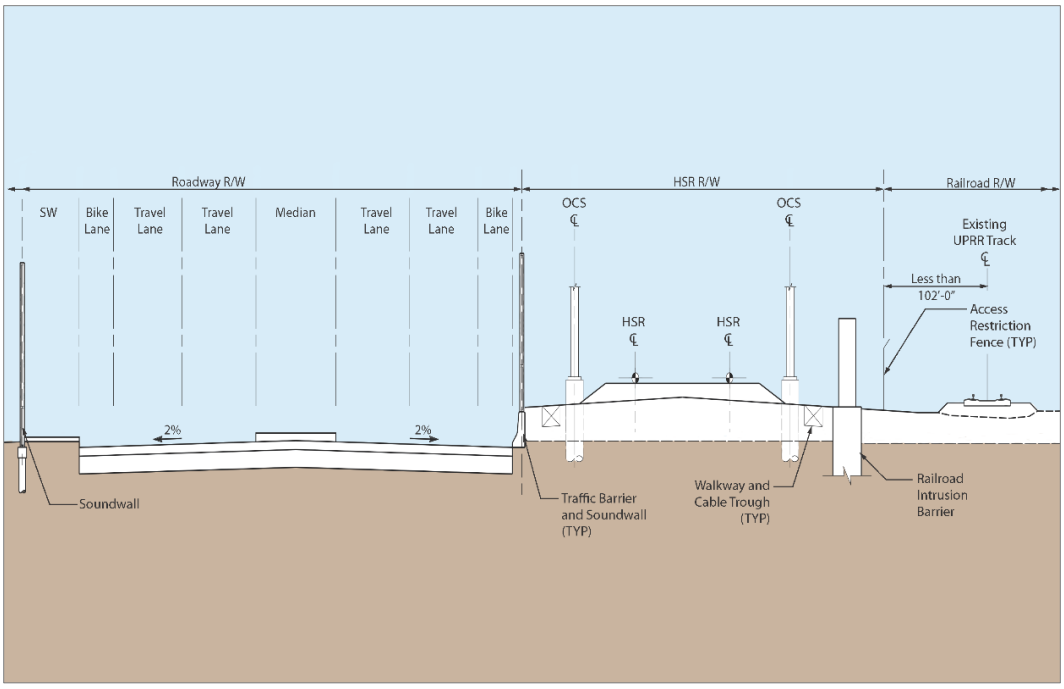
- **Operational facilities**—HSR operational requirements include traction power distribution, ATC, communications and maintenance facilities, and underground or overhead power transmission lines. Working in coordination with power supply companies and in accordance with design requirements, the Authority has identified frequency and right-of-way requirements for traction power distribution facilities.
- **SR 87, SR 89, SR 101, SR 152, I-5, and I-880 adjacency**—The project follows or traverses SR 87, SR 89, SR 101, SR 152, I-5, and I-880, crossing over these routes in some locations and under them in others. In some instances, the at-grade HSR guideway may cross the roadway approaches of these highway overcrossings and interchange elements. Construction of the project could entail replacement of some major state facilities, overcrossings, and interchanges to maintain horizontal and vertical clearances over the highway right-of-way or to avoid traffic impacts during construction. These project components are discussed for each alternative in State Highway and Local Roadway Modifications later in this section.
- **UPRR adjacency**—The project in the Monterey Corridor and the Morgan Hill and Gilroy Subsections is designed to follow the existing UPRR corridor adjacent to the UPRR mainline right-of-way under Alternative 2, and to follow some portions of it under Alternative 1. Alternative 3 is designed to further minimize interaction with the UPRR right-of-way. Alternative 4 is designed to maximize use of existing Caltrain and UPRR right-of-way to reduce additional right-of-way impacts.

  From Tamien Station to Bloomfield Avenue in Gilroy, the UPRR and proposed HSR tracks run parallel for 24.4 miles under Alternative 1, 31.4 miles under Alternative 2, and 16.4 miles under Alternative 3. Under Alternative 4, UPRR and HSR would run in parallel for 37.4 miles—from De La Cruz Boulevard to Bloomfield Avenue. In several locations, the HSR would be elevated to cross over the UPRR operational right-of-way. In these instances, the HSR would maintain required horizontal and vertical clearance over the UPRR's operational right-of-way to avoid or minimize impacts on other UPRR rights-of-way, spurs, and facilities. Alternatives 1, 2, and 3 are designed to avoid the existing UPRR operations right-of-way and active rail spurs to the greatest extent practicable, and to maximize use of existing transportation corridors. Figure 2-40 and Figure 2-41 illustrate different cross-section configurations that provide vertical and horizontal separation of the HSR track from the adjacent UPRR right-of-way boundary. Figure 2-9 illustrates the blended, at-grade cross-section that would be deployed for Alternative 4. The interaction with the UPRR right-of-way would vary by alternative as follows:

  – Alternative 1 would limit longitudinal encroachments into the UPRR right-of-way, but would require acquisition of 28 acres of UPRR right-of-way and another 34 acres for temporary construction easements (TCE) for UPRR relocations or crossings and the Downtown Gilroy Station.

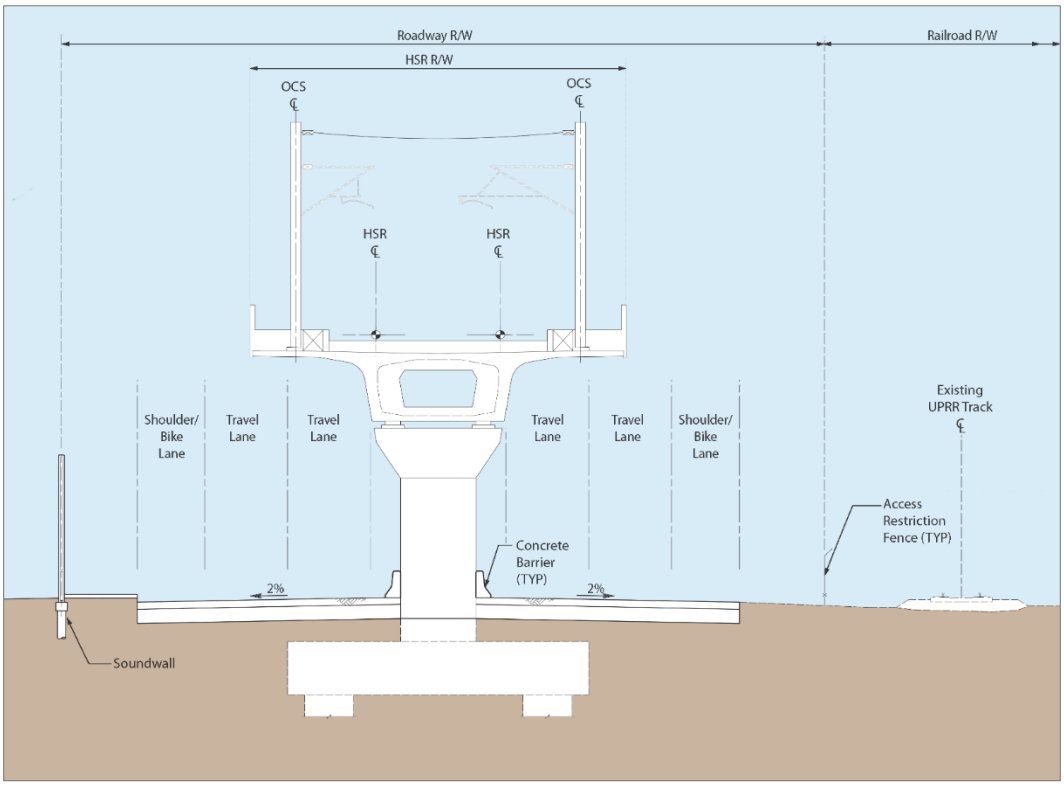
  – Alternative 2 would raise the UPRR tracks onto embankment for the southbound approach into downtown Gilroy and at the HSR station, and would require 36 acres of UPRR right-of-way and 257 acres for TCEs for UPRR relocations or crossings, roadway grade separations, and the Downtown Gilroy Station.

  – Alternative 3 would entail the least amount of longitudinal encroachments or acquisition of other UPRR right-of-way for the East Gilroy Station, but it would require 8 acres of UPRR right-of-way and 13 acres for TCEs.



APRIL 2017

Figure 2-40 At-Grade Cross-Section Configuration for UPRR Adjacency



AUGUST 2017

Figure 2-41 Viaduct Cross-Section Configuration for UPRR Adjacency

  - Alternative 4 would require the most longitudinal encroachments or acquisition of UPRR right-of-way. From Communications Hill to the MOWF south of Gilroy, HSR would install two electrified blended HSR tracks and one nonelectrified freight track predominantly within the existing UPRR right-of-way. An additional 2,500-foot-long freight siding track would be provided. A dedicated freight track would also be provided from De La Cruz Boulevard to Communications Hill within the Caltrain right-of-way. UPRR spur and industrial tracks would be maintained from De La Cruz Boulevard to the MOWF, and a dedicated freight connection to the South Gilroy MOWF would be provided within the HSR right-of-way. The UPRR Hollister subdivision would be realigned to accommodate the MOWF and associated freight and HSR tracks. Within the UPRR right-of-way (south of Communications Hill) along the Coast line, there would be 37.4 miles of realignment. An additional 1.7 miles of the UPRR Hollister subdivision would be realigned.

- **Temporary construction easements**—TCEs would be required along the length of the proposed alignment ranging from isolated maximum widths of 486 feet for Alternative 1 to 568 feet for Alternative 2. The area of HSR TCEs (compared to TCEs for utilities) varies from 655 acres for Alternative 4 to 1,245 acres for Alternative 2; Alternatives 1 and 3 would require 1,057 and 1,080 acres, respectively.
- **Permanent acquisitions**—Permanent right-of-way acquisitions would be required at alignment crossings.

Stations

Two stations would be constructed for the project: San Jose and Gilroy. The HSR San Jose Diridon Station would be constructed at the existing Caltrain station. The station configuration is the same for Alternatives 1, 2, and 3, while under Alternative 4 it would be built as an at-grade station. A second station—in the Morgan Hill and Gilroy Subsection—would be constructed in either downtown Gilroy or east Gilroy, depending on the alternative selected. Conceptual station plans provide space for a multitude of services, including local and regional transit connectivity, pick-up and drop-off facilities, parking, a station building for ticketing and support services, and an HSR passenger waiting and access area. Station planning incorporates pedestrian and bicyclist connectivity; improved station area roadways to facilitate connectivity; expanded sidewalks, pathways, and plazas; rider pick-up and drop-off areas; and vehicle parking. Table 2-9 shows the features of the San Jose Diridon Station and Table 2-10 shows a comparison of the station alternatives for Gilroy.

Table 2-9 Summary of Diridon Station Features

Feature	Alternatives 1, 2, and 3	Alternative 4
Vertical profile and height (top of rail)	Aerial (62 feet)	At grade (less than 1 foot)
Platform location	Platforms above existing Caltrain rail yard centered between Santa Clara and Park Streets	Existing platforms raised and extended for HSR use
Platform length	1,410 feet	1,385 feet and 1,465 feet
Rail connections	Caltrain, ACE, Amtrak, VTA light rail, future BART	Caltrain, ACE, Amtrak, VTA light rail, future BART
Parking (existing and displaced)	226 (Amtrak 61; Caltrain 165) displaced spaces replaced 1:1 with new parking at Cahill/Park Streets and a second site at Stockton/Alameda Streets	161 (Amtrak 61; Caltrain 100) displaced spaces replaced 1:1 with new parking at Cahill/Crandall Streets and a second site at Stockton/Alameda Streets

Feature	Alternatives 1, 2, and 3	Alternative 4
HSR parking supply	MOA demand of 1,050 spaces would be met by commercially available parking downtown and at airport	MOA demand of 1,050 spaces would be met by commercially available parking downtown and at airport
Bus transit	Existing on-site transit center to be relocated to on-street location on Cahill, Stover, and Crandall Streets	Existing on-site transit center to be relocated to off-street location at Cahill and Crandall Streets
Pick-up/drop-off (curb length)	On-street along Cahill St and Otterson St (1,900 feet meets 1,900-foot demand)	On-street along Cahill St, Stover St, Crandall St, S. Montgomery St, and Otterson St (1,900 feet meets 1,900-foot demand)
Pedestrian	Transit plaza	Transit plaza
Bicycle	4,000-square-foot facility	4,000-square-foot facility
Street access	Cahill St reconfigured and extended from Santa Clara to Park St; Stover and Crandall Streets extended to S. Montgomery St	Cahill St reconfigured and extended from Santa Clara to Otterson St; Stover and Crandall Streets extended to S. Montgomery St
Station access (transit, pick-up/drop-off, bike)	On-street pick-up/drop-off along Cahill St, designed as transit street with 12 to 15 bus stops New two-way cycle tracks on east side of Cahill St; new signals and pedestrian crossings at Cahill St and Park, Otterson, Stover, W San Fernando, and Crandall Streets. Additional pick-up/drop-off along east side of Cahill St between Park and Otterson and along Otterson	On-street pick-up/drop-off along Cahill St, Otterson St, Stover St, Crandall St, and S Montgomery New one-way bike lanes on either side of Cahill St; new signals and pedestrian crossings at Cahill and Stover, and Cahill and Crandall Streets.
Entrance	Three east side entrances: main entrance on east side of tracks, north of the existing Historic Depot next to the future BART alignment; south of the existing historic Diridon station building; and south of PG&E power station. Three west side entrances: north at end of White Street and two on Laurel Grove, one north and one south	Two east side entrances from Cahill, north and south of Historic Depot. Two west side entrances, one from Laurel Grove Ln and one from White St
Program area	99,289-square-footbuilding 4,400-square-foot substation and systems	50,478-square-foot building 4,400-square-foot substation and systems
Concourse configuration	Mezzanine above existing tracks; below HSR platforms, concourse has three east/west connections across tracks at north, south, and middle of concourse	Two concourses above existing tracks with connections to all platforms

ACE = Altamont Corridor Express; BART = Bay Area Rapid Transit; HSR = high-speed rail; MOA = memorandum of agreement; PG&E = Pacific Gas and Electric Company; VTA = (Santa Clara) Valley Transportation Authority

Table 2-10 Comparison of Alternative Gilroy Station Features

Feature	Description			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Vertical profile and height (top of rail)	Low viaduct (32.77 feet)	Embankment (15.75 feet)	Embankment (16.83 feet)	At-grade (2.96 feet)
Platform location	Dedicated HSR tracks east of UPRR between relocated Old Gilroy/7th St and 9th St	Dedicated HSR tracks east of UPRR between relocated Old Gilroy/7th St and 9th St	North of Leavesley Rd	Dedicated HSR tracks west of UPRR between former Old Gilroy/7th St and 9th St
Platform length	800 feet	800 feet	800 feet	800 feet
Rail connections	Caltrain, TAMC (future service)	Caltrain, TAMC (future service)	none	Caltrain, TAMC (future service)
Parking (existing and displaced)	471 displaced Caltrain spaces replaced 1:1 with new parking to the west and east of the station; 269 displaced spaces from the San Ysidro housing development replaced 1:1 with new surface parking at south end of Alexander Street	471 displaced Caltrain spaces replaced 1:1 with new parking to the west and east of the station; 269 displaced spaces from the San Ysidro housing development replaced 1:1 with new surface parking at south end of Alexander Street	No displacement, all new	471 displaced Caltrain spaces replaced 1:1 with new parking to the west and east of the station; 269 displaced spaces from the San Ysidro housing development replaced 1:1 with new surface parking along Automall Parkway with access from the south end of Alexander Street
HSR parking supply	970 (2040) on-site supply meets MOA demand 1,710 planned spaces in 2040 compensates for HSR demand plus displaced existing parking	970 (2040) on-site supply meets MOA demand 1,710 planned spaces in 2040 compensates for HSR demand plus displaced existing parking	1,520 (2040) on-site supply meets MOA demand	970 (2040) on-site supply meets MOA demand 1,710 planned spaces in 2040 compensates for HSR demand plus displaced existing parking
Bus transit	On site total of eight bus bays	On site total of eight bus bays	On site would add seven bus berths	On site total of eight bus bays
Pick-up/drop-off (curb length)	On site, east and west sides of station West side (370 feet) front of historic station East side (900 feet) front and sides of station, access from Alexander St and new station access streets	On site, east and west sides of station West side (370 feet) front of historic station East side (900 feet) front and sides of station, access from Alexander St and new station access streets	On site, east and west sides of station 400 feet west side to south of station 500 feet east side in front of station	On site, east and west sides of station West side (370 feet) front of historic station East side (900 feet) front and sides of station, access from Alexander St and new station access streets

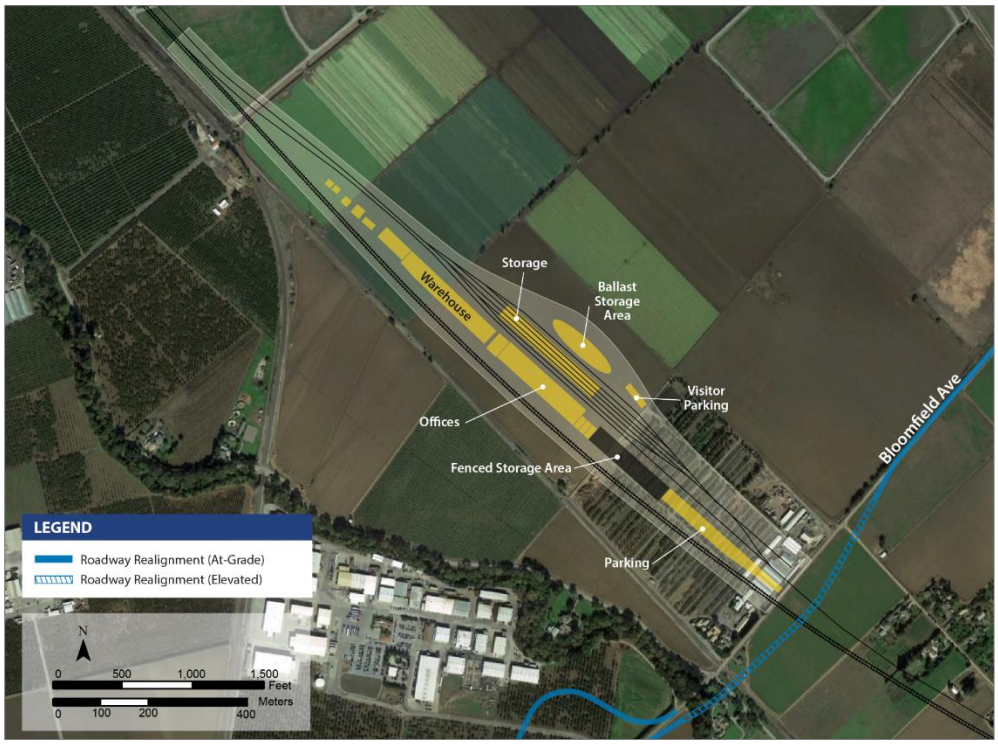
Feature	Description			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Pedestrian	Transit plaza	Transit plaza	Transit plaza	Transit plaza, Overcrossing along 7th Street alignment
Bicycle	4,000-square-foot facility	4,000-square-foot facility	4,000-square-foot facility	4,000-square-foot facility
Off-Site Facilities				
Street access	Existing grade crossings unchanged (except realignment of Old Gilroy/ 7th St)	9th street goes through and station access streets connect to existing grid, realignment of Old Gilroy/7th St	West entrance from Leavesley; east entrance from Marcella; additional road connection on west side to Las Animas and on east side to Marcella	Old Gilroy/7th St. crossing closed
Station access (transit, pick-up/drop-off, bike)	Class II bike lanes on 7th and Alexander	Class II bike lanes on 7th, 10th and Alexander	Bikes: New Class III bike route from outlet mall to site entrance, then Class II lanes from station entrance to parking, Class I bi-directional off-street path adjacent to parking that connects to bike station	Existing bike facilities
Entrance	Main auto and bike entrance on east side; main pedestrian, transit on west side	Main auto and bike entrance on east side; main pedestrian, transit on west side	Main entrance on west side	Main auto and bike entrance on east side; main pedestrian, transit on west side
Program area	60,513-square-foot building 4,400-square-foot substation and systems	60,513-square-foot building 4,400-square-foot substation and systems	58,611-square-foot building 4,400-square-foot substation and systems	57,000-square-foot building 4,400-square-foot substation and systems
Concourse configuration	Below existing UPRR and Caltrain tracks	Below raised UPRR and Caltrain tracks	Under tracks and embankment	Above HSR and realigned UPRR and Caltrain tracks

HSR = high-speed rail; TAMC = Transportation Agency for Monterey County; UPRR = Union Pacific Railroad

Maintenance Facilities

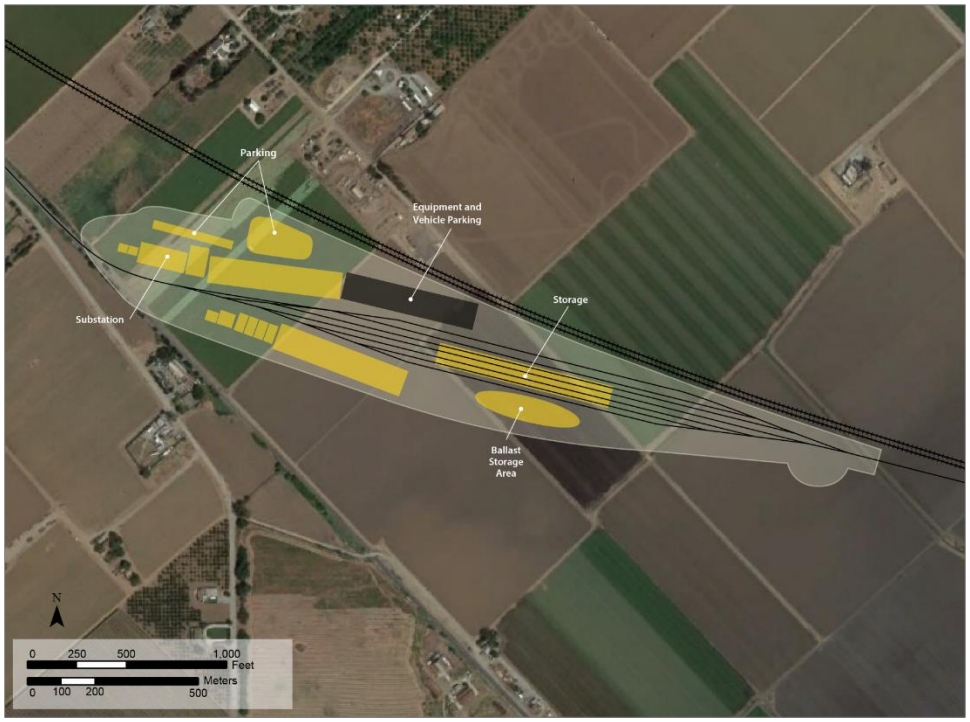
Three sites for the MOWF are under consideration:

- The South Gilroy MOWF would be in one of two locations--between Carnadero Avenue and Bloomfield Avenue on the east side of the HSR alignment under Alternatives 1 and 2 (Figure 2-42) or south of Bloomfield Avenue on the on the west side of the HSR alignment (Figure 2-43) under Alternative 4.
- The East Gilroy MOWF would be west of the HSR mainline, south of the community of Old Gilroy under Alternative 3. The MOWF would extend from north of Pacheco Pass Highway (SR 152) to north of Bloomfield Avenue (Figure 2-44).



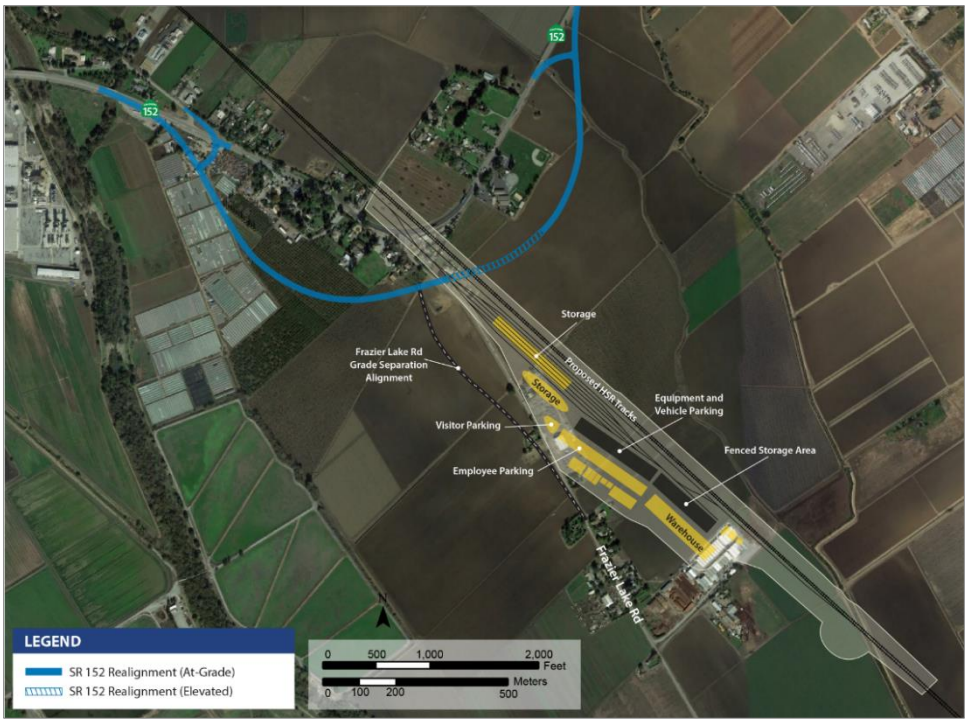
Source: Authority 2019a JUNE 2019

Figure 2-42 South Gilroy Maintenance of Way Facility (Alternatives 1 and 2)



Source: Authority 2019a JUNE 2019

Figure 2-43 South Gilroy Maintenance of Way Facility (Alternative 4)

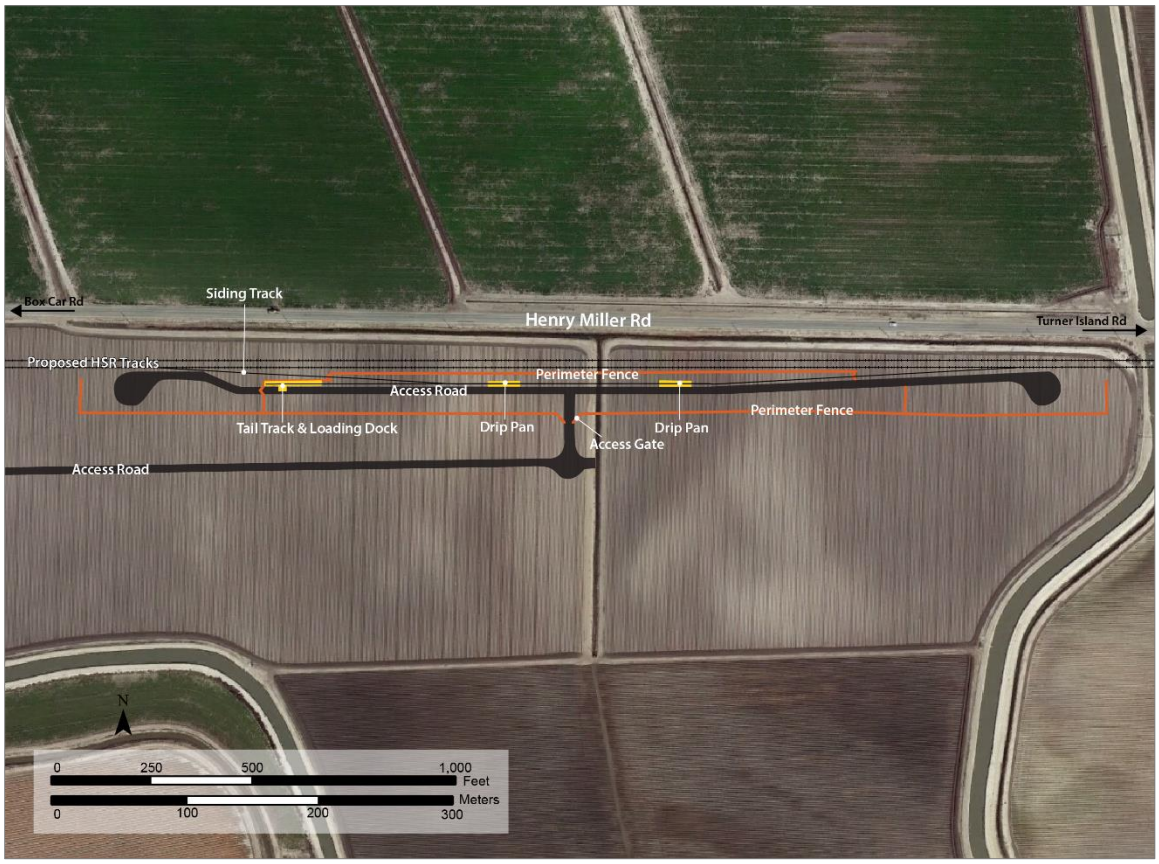


Source: Authority 2019a JUNE 2019

Figure 2-44 East Gilroy Maintenance of Way Facility (Alternative 3)

Under Alternatives 1, 2, and 3, the MOWF would encompass approximately 75 acres; the Alternative 4 MOWF would encompass approximately 50 acres. MOWFs provide storage of infrastructure inventory as well as stockpile areas for ballast and other bulk materials. MOWFs provide for dispatch, maintenance, and repair of rail-mounted equipment and include support quarters for maintenance personnel. The MOWF would occupy a linear site adjacent to the HSR mainline tracks (rail side unloading dock as well as 1,600 feet of train storage) with a maximum width of seven tracks (six yard tracks plus one siding track). It would be approximately 0.75 mile long. While most access is by rail, MOWFs also provide road-rail vehicle access locations. Security fencing 8 to 15 feet high and (depending on local conditions) a noise barrier 20 to 40 feet high would enclose the site. The site would be staffed by 75 to 150 personnel with continuous 24-hour operation; however, nighttime hours (9 p.m.–7 a.m.) would be busiest with deployment of rail-mounted equipment. Pole-mounted floodlights 50 to 100 feet tall would provide lighting for buildings, pathways, and trackwork. The South Gilroy MOWF for Alternatives 1 and 2 is described in Section 2.6.2.5, Alternative 1; the East Gilroy MOWF is described in Section 2.6.2.6, Alternative 3; and the South Gilroy MOWF for Alternative 4 is described in Section 2.6.2.7.

An MOWS would be constructed in the San Joaquin Valley Subsection near Turner Island Road (Figure 2-45). The MOWS would occupy an approximately 4-acre linear site adjacent to the HSR mainline tracks with one 1,600-foot siding track and a 200-foot tail track. An MOWS provides sufficient storage for on-track equipment to be strategically placed prior to the beginning of overnight maintenance access. The MOWS would support maintenance activities by providing a location for layover of equipment and temporary storage of materials such as ballast and other bulk materials as well as secured storage for non-bulk materials. The goal is to reduce travel time required to arrive at the maintenance location by providing access via rail, thereby enhancing the efficiency and productivity of these activities. The site would be secured with keypad access for limited vehicle access. The design includes parking for 10 to 20 vehicles. Like activities at the MOWFs, MOWS operations are more active at night, with about 30 to 40 staff. Nighttime lighting would include perimeter lighting as well as floodlights for buildings, pathways, and trackwork.



Source: Authority 2019a JUNE 2019

Figure 2-45 Maintenance of Way Siding near Turner Island Road

Safety and Security

The system safety and system security program for the development and operation of HSR is described in the Authority's SSMP (Authority 2016b). The SSMP includes the Authority's Safety and Security Policy Statement, roles and responsibilities for safety and security across the system, the program for managing safety hazards and security threats/vulnerabilities, safety and security certification program requirements, and construction safety and security requirements.

State Highway and Local Roadway Modifications

State Highway Underpasses

Where the HSR alignment is proposed to cross over state highway facilities on aerial structures, the possibility of encroachment into the Caltrans right-of-way would depend on the placement of the HSR aerial structure columns. Temporary closure of the Caltrans right-of-way may be necessary for placement of precast aerial structure sections. Traffic would be detoured onto local streets during such closures.

Roadway Overcrossings

Where the HSR alignment is at grade and runs parallel to state facilities, access would be severed where an at-grade leg of an intersection crosses the HSR alignment. Accordingly, road overcrossings would be necessary to maintain function of the state highway and local road systems. Intersecting roads would be realigned horizontally and adjusted vertically to cross over the state highway. The possibility of encroachment into the Caltrans right-of-way would depend on the placement of the overcrossing columns. The design intent of these crossings is to maintain the existing intersection and traffic patterns during construction. However, when conforming to the

existing roads, some short-term closures may be required, and local traffic would use one of the other overcrossings or intersections in the vicinity.

Eliminating Leg of Intersections

The elimination of one leg of an existing at-grade intersection with a state highway was deemed necessary where the road was close to other accessible, proposed overcrossings, or where the existing average annual daily traffic was not high enough to warrant its own overcrossing. In these circumstances, the access would be severed along the leg of the intersection that the HSR track traverses. There would be no impacts on the Caltrans right-of-way as no structures are required. Local traffic would use one of the other overcrossings in the vicinity.

Bridge Retrofits

Some existing bridges over HSR may require retrofit where a structural deficiency has been identified or where there is insufficient information currently available to make such a determination (Table 2-11). The bridges have not been identified as requiring replacement under the project, but they may be in need of seismic or other improvements to meet HSR performance criteria; consequently, there is a potential need for them to be retrofitted or replaced once more detailed analysis is performed in a later design phase. Typically, in such instances the right-of-way is preserved on the crossing roadway network to the conform[10] line.

Table 2-11 Existing Bridges That Could Require Retrofit

Bridge	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Lafayette St pedestrian overcrossing	X			X
W San Carlos Ave				X
Blossom Hill Rd		X		X
Capitol Expressway		X		
Bernal Ave		X		X

Ramp Modifications

Ramp modifications would be necessary where the HSR track is on an aerial structure and the proposed columns directly interfere with the existing alignments of roadways or off-ramps. These ramps would be modified to avoid the proposed columns and to accommodate any other roadway realignments that would result from the aerial structure columns. Although the modifications would be slight, additional right-of-way may be required for the realigned off-ramps. Roadway traffic would likely use existing facilities while the realigned ramps are being constructed.

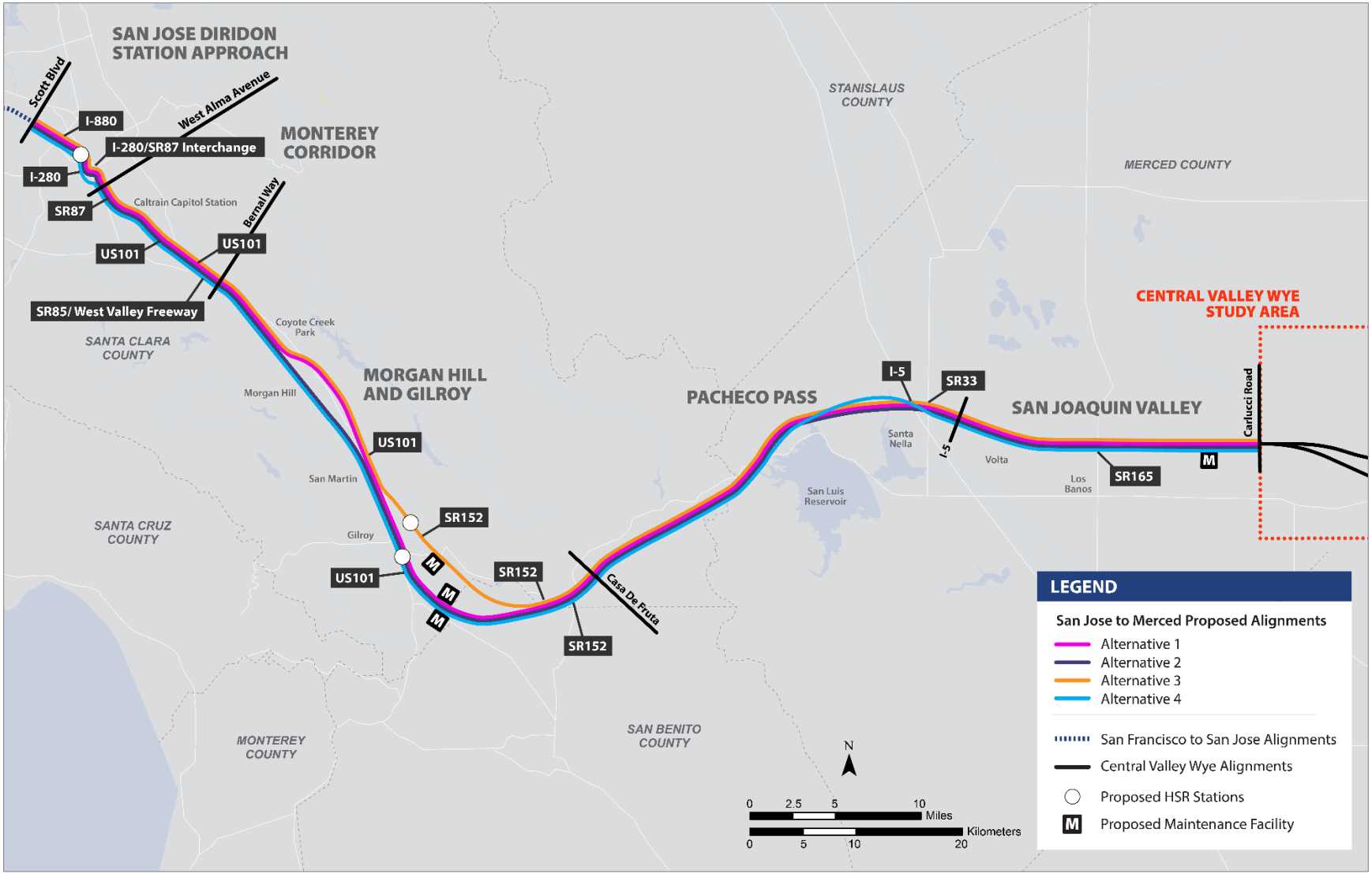
Table 2-12 shows the Caltrans facilities that would be affected by the project alternatives. Figure 2-46 illustrates their locations. Figure 2-47 through Figure 2-52 illustrate local roadway modifications that would be necessary under the project alternatives. A complete listing of these modifications is provided in Appendix 2-A, Table 2.

[10] The *conform line* is the area where the roadway that is being reconstructed returns to grade.

Table 2-12 Impact of HSR Alternatives on Caltrans Facilities

Facility	Description of Change	Alternative			
		1	2	3	4
I-880	TCE (1, 2, 3); permanent ROW acquisition (1); aerial structure/overcrossing (2, 3)	X	X	X	
I-280/SR 87 interchange	TCE; permanent ROW acquisition; aerial structure/overcrossing	X	X	X	
I-280	TCE, permanent ROW acquisition; aerial structure/overcrossing				X
SR 87	TCE; permanent ROW acquisition; closure of on-ramp adjacent to Tamien Station and relocation; new overcrossing (4 only)	X	X	X	X
SR 85/West Valley Frwy	TCE; permanent ROW acquisition; aerial structure/overcrossing (1, 3)	X	X	X	
US 101	TCE; permanent ROW acquisition; new trench undercrossing (2); at-grade/undercrossing (4); aerial structure/overcrossing (1, 3)	X	X	X	X
SR 152	TCE; permanent ROW acquisition; aerial structure overcrossings	X	X	X	X
SR 152	TCE; permanent ROW acquisition; new overcrossing and tunnel facilities	X	X	X	X
I-5	TCE; permanent ROW acquisition; aerial structure/overcrossing; road realignment	X	X	X	X
SR 33	TCE; permanent ROW acquisition; new overcrossing	X	X	X	X
SR 165	TCE; permanent ROW acquisition; embankment/bridge structure; HSR undercrossing	X	X	X	X

ROW = right-of-way
I = Interstate
SR = State Route
TCE = temporary construction easement



Source: Authority 2019a

JUNE 2019

Figure 2-46 Location of State Highways or Routes Affected by HSR Alternatives

San Jose
San Francisco To San Jose Project Section
Scott Blvd
101
87
680
880
280
SAN JOSE DIRIDON STATION APPROACH
De La Cruz Blvd. (Alt 2 & 3)
Grant St. (Alts 2 & 3)
West Hedding St. (Alts 2 & 3)
Stockton Ave. (Alts 1, 2 & 3)
University Ave. (Alts 1, 2 & 3)
West Hedding St. (Alt 1)
Emory St. (Alts 1, 2 & 3)
Chestnut St. (Alts 1, 2 & 3)
Chestnut St. (Alts 2 & 3)
West Taylor St. (Alts 2 & 3)
West Taylor St. (Alts 1 & 4)
North Montgomery (Alts 1, 2 & 3)
SAN JOSE DIRIDON STATION
Stover St. (Alts 1, 2 & 3)
Crandall St. (Alts 1, 2 & 3)
Cahill St. (Alts 1, 2 & 3)
Auzerais Ave. (Alt 4)
W. Virginia St. (Alt 4)
Fuller Ave. (Alt 4)
NB 87 On-Ramp (Alts 1, 2 & 3)
West Alma Avenue
LEGEND
Roadway Modifications
Road Closure
Lane Narrowing
Road Widening
Alignment Change
Grade Separation
Other Roadway Change
Quad Gate
HSR Alignments
Proposed HSR Stations
N
0 0.5 1 2
Miles
Kilometers
0 0.5 1 2

Source: Authority 2019a JANUARY 2020
Note: Description of modifications is provided in Table 1 in Appendix 2-A.

Figure 2-47 Local Roadway Modifications Required for HSR—San Jose Diridon Station Approach Subsection

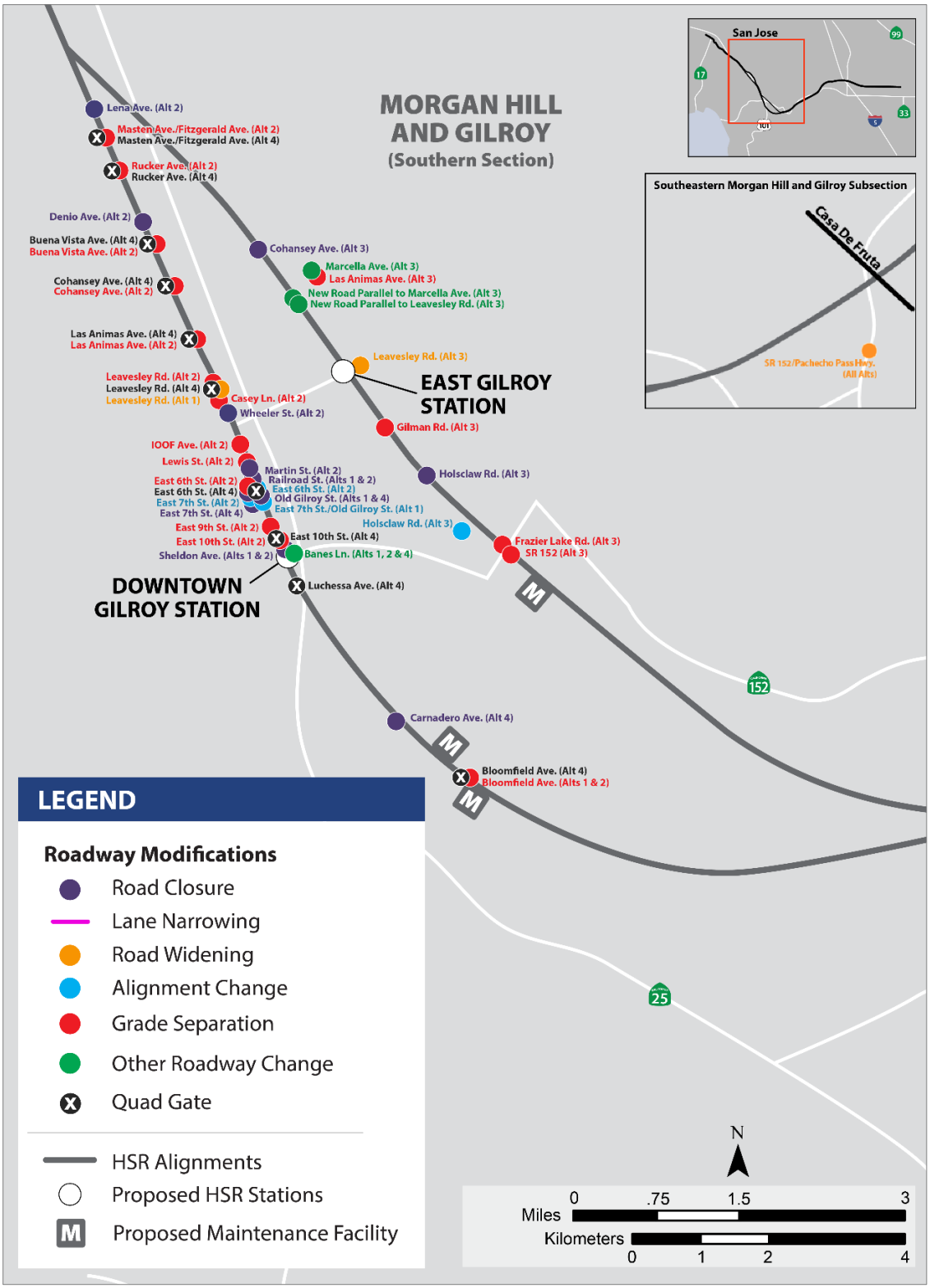
Source: Authority 2019a JUNE 2019
Note: Description of modifications is provided in Table 1 in Appendix 2-A.

Figure 2-48 Local Roadway Modifications Required for HSR—Monterey Corridor Subsection

San Jose
Bernal Way
MORGAN HILL AND GILROY
(Northern Section)
San Martin
Morgan Hill
Monterey Rd. (Alts 1 & 3)
Monterey Rd. (Alts 1 & 3)
Blanchard Rd. (Alt 4)
Blanchard Rd. (Alt 2)
Monterey Rd. (Alt 2)
Emado Ave. (Alt 2 & 4)
Emado Rd. (Alt 2)
Charter Access Rd. (Alt 2)
Rich mond Ave. (Alt 4)
Fox Ct. (Alts 2 & 4)
Fox Ln. (Alts 2 & 4)
Palm Ave. (Alt 4)
Palm Ave. (Alt 2)
Palm Ave. (Alt 1)
Monterey Rd. (Alt 1)
Ogier Ave. (Alts 1 & 3)
Church Ave. (Alt 2)
Live Oak Ave. (Alt 4)
Live Oak Ave. (Alt 2)
Tilton Ave. (Alt 4)
Tilton Ave. (Alt 2)
Madrone Parkway (Alt 2)
Monterey Rd. (Alt 1)
Monterey Rd. (Alt 2)
East Central Ave. (Alt 2)
East Main Ave. (Alt 4)
East Main Ave. (Alt 2)
Depot St. (Alt 2)
East Dunne Ave. (Alt 4)
East Dunne Ave. (Alt 2)
Diana Ave. (Alts 2 & 4)
San Pedro Ave. (Alts 1 & 3)
San Pedro Ave. (Alt 4)
San Pedro Ave. (Alt 2)
Barrett Ave. (Alts 1 & 3)
Caputo Dr. (Alt 2)
Tennant Ave. (Alt 4)
Tennant Ave. (Alt 2)
Railroad Ave. (Alt 2)
Monterey Rd. (Alt 2)
Fisher Ave. (Alts 1 & 3)
East Middle Ave. (Alt 4)
East Middle Ave. (Alt 2)
Colony Ave. (Alt 2)
Monterey Rd. (Alt 2)
Oak St. (Alt 2)
East San Martin St. (Alt 4)
East San Martin St. (Alt 2)
South St. (Alts 1 & 3)
Lincoln Ave. (Alt 2)
Church Ave. (Alt 4)
LEGEND
Roadway Modifications
Road Closure
Lane Narrowing
Road Widening
Alignment Change
Grade Separation
Other Roadway Change
Quad Gate
HSR Alignments
Proposed HSR Stations
N
0 .75 1.5 3
Miles
Kilometers
0 1 2 4

Source: Authority 2019a JUNE 2019
Note: Description of modifications is provided in Table 1 in Appendix 2-A.

Figure 2-49 Local Roadway Modifications Required for HSR—Morgan Hill and Gilroy Subsection (Northern Section)

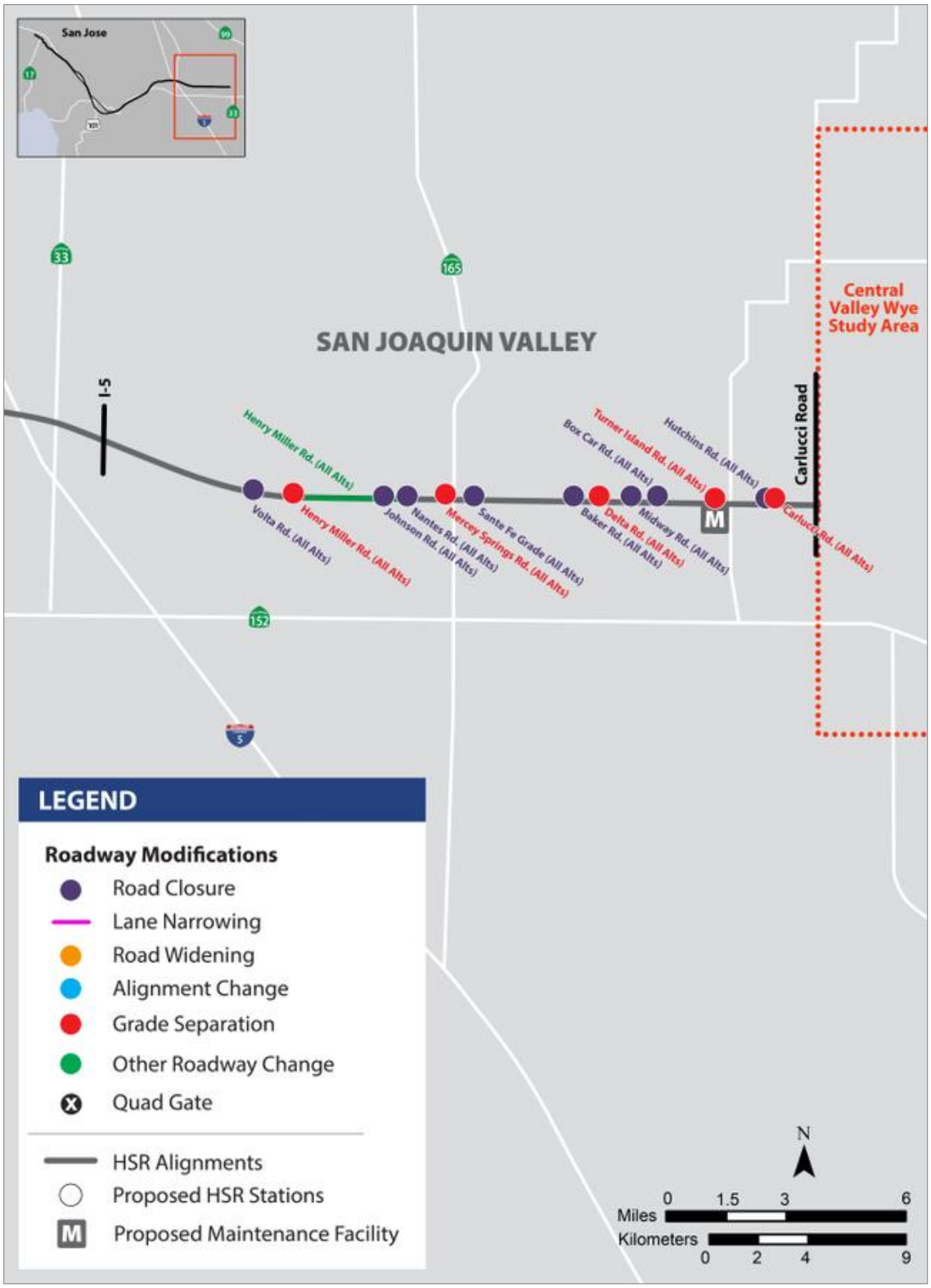

MORGAN HILL AND GILROY
(Southern Section)
San Jose
Southeastern Morgan Hill and Gilroy Subsection
Casa De Fruta
SR 152/Pachecho Pass Hwy. (All Alts)
Lena Ave. (Alt 2)
Masten Ave./Fitzgerald Ave. (Alt 2)
Masten Ave./Fitzgerald Ave. (Alt 4)
Rucker Ave. (Alt 2)
Rucker Ave. (Alt 4)
Denio Ave. (Alt 2)
Buena Vista Ave. (Alt 4)
Buena Vista Ave. (Alt 2)
Cohansey Ave. (Alt 4)
Cohansey Ave. (Alt 2)
Las Animas Ave. (Alt 4)
Las Animas Ave. (Alt 2)
Leavesley Rd. (Alt 2)
Leavesley Rd. (Alt 4)
Leavesley Rd. (Alt 1)
Casey Ln. (Alt 2)
Wheeler St. (Alt 2)
IOOF Ave. (Alt 2)
Lewis St. (Alt 2)
East 6th St. (Alt 2)
East 6th St. (Alt 4)
East 7th St. (Alt 2)
East 7th St. (Alt 4)
East 9th St. (Alt 2)
East 10th St. (Alt 2)
Sheldon Ave. (Alts 1 & 2)
Martin St. (Alt 2)
Railroad St. (Alts 1 & 2)
East 6th St. (Alt 2)
Old Gilroy St. (Alts 1 & 4)
East 7th St./Old Gilroy St. (Alt 1)
East 10th St. (Alt 4)
Banes Ln. (Alts 1, 2 & 4)
Luchessa Ave. (Alt 4)
Cohansey Ave. (Alt 3)
Marcella Ave. (Alt 3)
Las Animas Ave. (Alt 3)
New Road Parallel to Marcella Ave. (Alt 3)
New Road Parallel to Leavesley Rd. (Alt 3)
Leavesley Rd. (Alt 3)
EAST GILROY STATION
Gilman Rd. (Alt 3)
Holsclaw Rd. (Alt 3)
Holsclaw Rd. (Alt 3)
Frazier Lake Rd. (Alt 3)
SR 152 (Alt 3)
DOWNTOWN GILROY STATION
Carnadero Ave. (Alt 4)
Bloomfield Ave. (Alt 4)
Bloomfield Ave. (Alts 1 & 2)
LEGEND
Roadway Modifications
Road Closure
Lane Narrowing
Road Widening
Alignment Change
Grade Separation
Other Roadway Change
Quad Gate
HSR Alignments
Proposed HSR Stations
Proposed Maintenance Facility
N
0 .75 1.5 3
Miles
Kilometers
0 1 2 4

Source: Authority 2019a JANUARY 2020
Note: Description of modifications is provided in Table 1 in Appendix 2-A.

Figure 2-50 Local Roadway Modifications Required for HSR—Morgan Hill and Gilroy Subsection (Southern Section)

Source: Authority 2019a JUNE 2019
Note: Description of modifications is provided in Table 1 in Appendix 2-A.

Figure 2-51 Local Roadway Modifications Required for HSR—Pacheco Pass Subsection



Source: Authority 2019a JUNE 2019
Note: Description of modifications is provided in Table 1 in Appendix 2-A.

Figure 2-52 Local Roadway Modifications Required for HSR—San Joaquin Valley Subsection

2.6.2.3 HSR Project Impact Avoidance and Minimization Features

The Authority has committed to implementing impact avoidance and minimization features (IAMF) consistent with the Statewide Program EIR/EIS (Authority and FRA 2005), the Bay Area to Central Valley Program EIR/EIS (Authority and FRA 2008), and the Partially Revised Final Program EIR (Authority 2012b). The Authority would implement these features during project design and construction, as relevant to the project, to avoid or reduce impacts. These features are considered to be part of the project and are included as applicable in each of the alternatives for purposes of the environmental impact analysis. The full text of the IAMFs that are applicable to the project is provided in Appendix 2-E. Chapter 3 provides a brief description of each IAMF as well as its purpose in the context of each resource topic.

To address impacts on agricultural lands and dairy farms

- AG-IAMF#1: Restoration of Important Farmland Used for Temporary Staging Areas
- AG-IAMF#2: Permit Assistance
- AG-IAMF#3: Farmland Consolidation Program
- AG-IAMF#4: Notification to Agricultural Property Owners
- AG-IAMF#5: Temporary Livestock and Equipment Crossings
- AG-IAMF#6: Equipment Crossings

To control emissions from construction and operation

- AQ-IAMF#1: Fugitive Dust Emissions
- AQ-IAMF#2: Selection of Coatings
- AQ-IAMF#3: Renewable Diesel
- AQ-IAMF#4: Reduce Criteria Exhaust Emissions from Construction Equipment
- AQ-IAMF#5: Reduce Criteria Exhaust Emissions from On-Road Construction Equipment
- AQ-IAMF#6: Reduce the Potential Impact of Concrete Batch Plants

To address visual incompatibility

- AVQ-IAMF#1: Aesthetic Options
- AVQ-IAMF#2: Aesthetic Review Process

To minimize impacts on biological resources

- BIO-IAMF#1: Project Biologist
- BIO-IAMF#2: Agency Access
- BIO-IAMF#3: Construction Period WEAP Training
- BIO-IAMF#4: Operation and Maintenance Period WEAP Training
- BIO-IAMF#5: Prepare and Implement a Biological Resources Management Plan
- BIO-IAMF#6: Establish Monofilament Restrictions
- BIO-IAMF#7: Prevent Entrapment in Construction Materials and Excavations
- BIO-IAMF#8: Delineate Equipment Staging Areas and Traffic Routes
- BIO-IAMF#9: Dispose of Construction Spoils and Waste
- BIO-IAMF#10: Clean Construction Equipment
- BIO-IAMF#11: Maintain Construction Sites
- BIO-IAMF#12: Design the Project to be Bird Safe

To minimize effects on cultural resources

- CUL-IAMF#1: Geospatial Data Layer and Archaeological Sensitivity Map
- CUL-IAMF#2: WEAP Training Session
- CUL-IAMF#3: Pre-Construction Cultural Resource Surveys
- CUL-IAMF#4: Relocation of Project Features when Possible
- CUL-IAMF#5: Archaeological Monitoring Plan and Implementation
- CUL-IAMF#6: Pre-Construction Conditions Assessment, Plan for Protection of Historic Built Resources, and Repair of Inadvertent Damage

- CUL-IAMF#7: Built Environment Monitoring Plan
- CUL-IAMF#8: Implement Protection and/or Stabilization Measures

To minimize electromagnetic issues

- EMI/EMF-IAMF#1: Preventing Interference with Adjacent Railroads
- EMI/EMF-IAMF#2: Controlling Electromagnetic Fields/Electromagnetic Interference

To minimize geologic issues and paleontological resources

- GEO-IAMF#1: Geologic Hazards
- GEO-IAMF#2 Slope Monitoring
- GEO-IAMF#3 Gas Monitoring
- GEO-IAMF#4 Historic or Abandoned Mines
- GEO-IAMF#5 Hazardous Minerals
- GEO-IAMF#6: Ground Rupture Early Warning Systems
- GEO-IAMF#7: Evaluate and Design for Large Seismic Ground Shaking
- GEO-IAMF#8: Suspension of Operations during an Earthquake
- GEO-IAMF#9: Subsidence Monitoring
- GEO-IAMF#10: Geology and Soils
- GEO-IAMF#11: Engage a Qualified Paleontological Resources Specialist
- GEO-IAMF#12: Perform Final Design Review and Triggers Evaluation
- GEO-IAMF#13: Prepare and Implement a Paleontological Resource Monitoring and Mitigation Plan (PRMMP)
- GEO-IAMF#14: Provide WEAP Training for Paleontological Resources
- GEO-IAMF#15: Halt Construction, Evaluate, and Treat If Paleontological Resources Are Found

To address effects from hazardous materials and wastes

- HMW-IAMF#1: Property Acquisition Phase I and Phase 2 Environmental Site Assessments
- HMW-IAMF#2: Landfill
- HMW-IAMF#3: Work Barriers
- HMW-IAMF#4: Undocumented Contamination
- HMW-IAMF#5: Demolition Plans
- HMW-IAMF#6: Spill Prevention
- HMW-IAMF#7: Transport of Materials
- HMW-IAMF#8: Permit Conditions
- HMW-IAMF#9: Environmental Management System
- HMW-IAMF#10 Hazardous Materials Plans

To address effects on water quality and supply

- HYD-IAMF#1: Storm Water Management
- HYD-IAMF#2: Flood Protection
- HYD-IAMF#3: Prepare and Implement a Construction Stormwater Pollution Prevention Plan
- HYD-IAMF#4: Prepare and Implement an Industrial Stormwater Pollution Prevention Plan
- HYD-IAMF#5: Tunnel Design Features and Construction Methods

To minimize effects from stations and changes in land use

- LU-IAMF#1: HSR Station Area Development: General Principles and Guidelines
- LU-IAMF#2: Station Area Planning and Local Agency Coordination
- LU-IAMF#3: Restoration of Land Used Temporarily during Construction

To minimize noise and vibration

- NV-IAMF#1: Noise and Vibration

To minimize effects on parks, recreation, and open space

- PK-IAMF#1: Parks, Recreation, and Open Space

To minimize effects on public utilities and energy

- PUE-IAMF#1: Design Measures
- PUE-IAMF#2: Irrigation Facility Relocation
- PUE-IAMF#3: Public Notifications
- PUE-IAMF#4: Utilities and Energy

To maximize safety and security

- SS-IAMF#1: Construction Safety Transportation Management Plan
- SS-IAMF#2: Safety and Security Management Plan
- SS-IAMF#3: Hazard Analyses
- SS-IAMF#4: Oil and Gas Wells

To minimize socioeconomic effects and effects on communities

- SOCIO-IAMF#1: Construction Management Plan
- SOCIO-IAMF#2: Compliance with Uniform Relocation Assistance and Real Property Acquisition Policies Act
- SOCIO-IAMF#3: Relocation Mitigation Plan

To minimize transportation and circulation effects

- TR-IAMF#1: Protection of Public Roadways during Construction
- TR-IAMF#2: Construction Transportation Plan
- TR-IAMF#3: Off-Street Parking for Construction-Related Vehicles
- TR-IAMF#4: Maintenance of Pedestrian Access
- TR-IAMF#5: Maintenance of Bicycle Access
- TR–IAMF#6: Restriction on Construction Hours
- TR-IAMF#7: Construction Truck Routes
- TR-IAMF#8: Construction during Special Events
- TR-IAMF#9: Protection of Freight and Passenger Rail during Construction
- TR-IAMF#10: Off Peak Hour Employee Work Shift Changes at HMF
- TR-IAMF#11: Maintenance of Transit Access
- TR-IAMF#12: Pedestrian and Bicycle Safety

2.6.2.4 Alternative 1

Rationale

Development of Alternative 1 was intended to minimize the project footprint, minimize ground disturbance, minimize continuous surface features, and decrease necessary right-of-way acquisition through extensive use of viaduct structures and bypassing downtown Morgan Hill. It would minimize land use displacements and conversion by staying predominantly within the existing transportation corridor right-of-way, thereby minimizing impacts of the HSR infrastructure footprint on local communities and environmental resources. The vertical profile would be increased to minimize ground intrusion. Alternative 1 would incorporate the viaduct to I-880 design option, operating in blended service between Scott Boulevard and I-880 before transitioning to viaduct through most of the San Jose Diridon Station Approach Subsection. The alternative would continue predominantly on viaduct through the Monterey Corridor and Morgan Hill and Gilroy Subsections. This alternative is distinguished by an alignment around downtown Morgan Hill and a low viaduct approach to an aerial Downtown Gilroy Station. Alternative 1 would include an MOWF south of Gilroy. The alignment would continue predominantly on viaduct and embankment across the Soap Lake floodplain before entering a short tunnel (Tunnel 1) west of Casa De Fruta. The alignment and guideway in the Pacheco Pass Subsection would be the same for all four alternatives, entailing a long tunnel around the northern arm of the San Luis Reservoir

and viaducts over the California Aqueduct, Delta-Mendota Canal, and I-5. The alignment and guideway in the San Joaquin Valley Subsection would similarly be common to all four alternatives. East of the I-5 overcrossing, the guideway would be predominantly on embankment along the south side of Henry Miller Road to Carlucci Road, traveling on viaduct over major watercourses and through the GEA. Several local roadways would be relocated on bridges over the HSR embankment. An MOWS would be located near Turner Island Road.

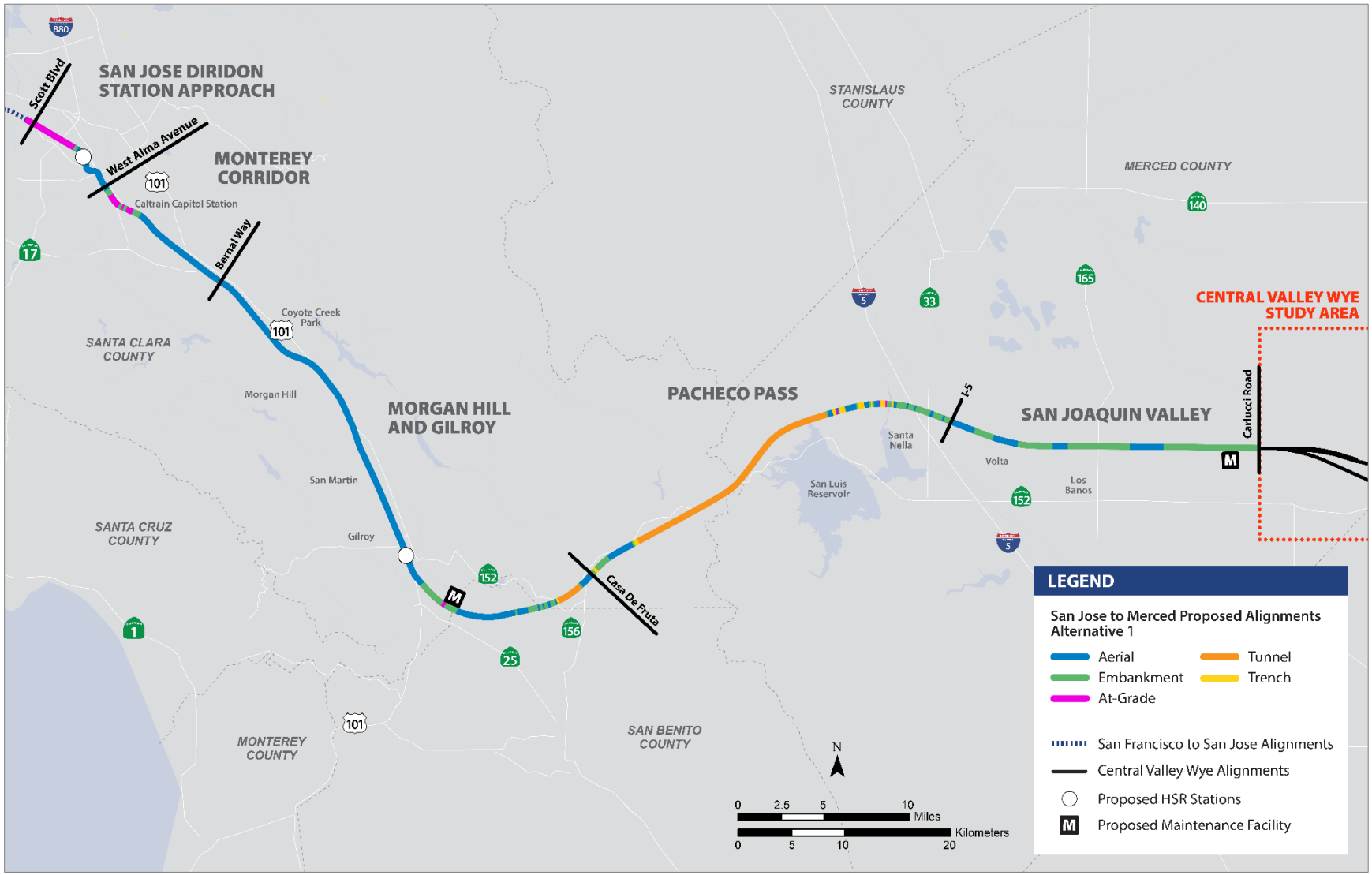
Overall, the HSR guideway under this alternative would comprise two tunnels totaling 15.0 miles, 45.4 miles of viaduct, 21.9 miles of embankment, 2.3 miles in trench, and 4.3 miles at grade in an excavated hillside cut. Figure 2-53 illustrates the primary design features of Alternative 1.

San Jose Diridon Station Approach Subsection

The San Jose Diridon Station Approach Subsection, from Scott Boulevard in Santa Clara to West Alma Avenue in San Jose, would be approximately 6 miles through the cities of Santa Clara and San Jose. The existing Caltrain track in this subsection consists of predominantly two-track and three-track at-grade alignment. South of De La Cruz Boulevard, UPRR tracks of the Coast Line from the northeast converge with the Caltrain corridor and continue south adjacent to the east side of the railroad corridor to the Santa Clara Caltrain Station. Between the Caltrain College Park Station and San Jose Diridon Station, Caltrain's Central Equipment and Maintenance Facility comprises three mainline tracks, a maintenance building, and nine yard tracks. San Jose Diridon Station includes five passenger platforms served by nine yard tracks along the west side of the station house. HSR would diverge from the Caltrain corridor at Park Avenue, just south of San Jose Diridon Station, returning to the Caltrain corridor at the north end of the Caltrain Tamien Station, which includes a passenger platform served by two tracks and a single through track.

Alignment and Ancillary Features

Alternative 1 would begin at Scott Boulevard in blended service with Caltrain at grade. Beginning at I-880 on the southbound approach to West Hedding Street, Caltrain tracks would be realigned to accommodate the HSR tracks. Dedicated HSR tracks would diverge from the Caltrain Mainline Track (MT) 2 and MT3 and continue south along the north side of the existing Caltrain corridor, crossing under West Hedding Street. To accommodate the new track configuration, the West Hedding Street roadway overpass would be replaced with a new overpass bridge that would also pass over Stockton Avenue.



Source: Authority 2019a

JUNE 2019

Figure 2-53 Alternative 1 Proposed Alignment

Southeast of West Hedding Street, the dedicated HSR tracks would transition from a two-track at-grade configuration to retained fill and finally to a two-track aerial profile. The HSR alignment would rise on embankment to an approximately 70-foot-high aerial structure. A new bridge structure would be constructed to carry the realigned UPRR/Caltrain MT2 over the West Taylor Street underpass. University Avenue would become a cul-de-sac. A new pedestrian underpass would be constructed near the alignment of Emory Street to allow Caltrain riders to reach both platforms of the Caltrain College Park Station. The HSR viaduct would cross over West Taylor Street, then shift horizontally a maximum of 500 feet east of the existing UPRR/Caltrain mainline tracks to maintain high-speed track curvature.

Both legs of the UPRR Warm Springs Subdivision Lenzen Wye would be relocated, and North Montgomery Street would be extended north of the alignment of Lenzen Avenue almost to the former Lenzen Wye to maintain property access beneath the 60-foot-high HSR viaduct. The HSR viaduct would cross over Cinnabar Street, both legs of the relocated Lenzen Wye and North Montgomery Street, West Julian Street, and West Santa Clara Street while curving west toward the UPRR/Caltrain mainline tracks to enter a new aerial dedicated HSR station at San Jose Diridon Station. Continuing on an aerial structure, the alignment would diverge from the Caltrain right-of-way south of the San Jose Diridon Station HSR platforms by turning sharply east at the Park Avenue overcrossing. The HSR aerial structure would cross over Los Gatos Creek and San Carlos Street, then over Royal Avenue and the intersection of Bird Avenue and Auzerais Avenue, then over the I-280/SR 87 interchange. Continuing south along the east side of SR 87, the HSR aerial structure would cross over West Virginia Street and the Guadalupe River Trail, then over the Caltrain rail bridge, the Guadalupe River, and Willow Street. The HSR aerial structure would continue south over the Caltrain Tamien Station on an alignment between Tamien Station and the SR 87 freeway, transitioning to the Monterey Corridor Subsection at West Alma Avenue.

Traction Power Sites and Power Connections

One new TPSS would be constructed in this subsection on the east side of the Caltrain corridor south of I-880 in San Jose (just southeast of the I-880 overcrossing). The TPSS would be interconnected to two new gas-insulated substation breaker-and-a-half bays. The bays would be installed within the fence line of the PG&E FMC substation, just north of the I-880 overcrossing, by means of an aerial double-circuit 115-kV tie-line.

Train Control and Communication Facilities

An enhanced ATC system would control the trains and comply with the FRA-mandated PTC requirements, including safe separation of trains, over-speed prevention, and work zone protection. This system would include communications towers at intervals of approximately 1.5–3 miles. Signaling and train control elements within the right-of-way would include 10- by 8-foot communications shelters that house signal relay components and microprocessor components, cabling to the field hardware and track, signals, and switch machines on the track. Communications towers in these facilities would use 6- to 8-foot-diameter 100-foot-tall poles. The communications facilities would be sited in the vicinity of track switches and would be grouped with other traction power, maintenance, station, and similar HSR facilities where possible. Where communications towers cannot be co-located with TPSSs or other HSR facilities, the communications facilities would be sited near the HSR corridor in a fenced area approximately 20 by 15 feet.

Under Alternative 1, there would be six ATC sites between I-880 in San Jose and the I-280 and SR-87 interchange:

- Two sites near the TPSS facility
- One site just north of the San Jose Diridon Station
- Three sites between Park Avenue and the proposed HSR crossing of SR 87

One standalone communications radio site would be built at one of two alternative locations, both south of Scott Boulevard along the east side of the Caltrain corridor.

Wildlife Crossings

There would be no wildlife crossings in this subsection.

Stations

The HSR San Jose Diridon Station is estimated to have up to 15,430 boardings in 2040. The station would entail a four-track aerial alignment over the existing Diridon station at approximately 62 feet to top of rail, with 1,410-foot-long platforms above the existing Caltrain rail yard centered between Santa Clara Street and Park Avenue (Figure 2-54 and Figure 2-55). The existing historic station would remain in place. The primary HSR station building would be constructed north of the existing station building, but it would continue to the south wrapping around the existing Caltrain station building. The HSR station building would be accessed from the east at three entrances: the main entrance east of the tracks and north of the existing historic station next to the future BART alignment; an entrance south of the existing historic station; and an entrance on the east side of the alignment and south of the PG&E power station.[11] There would also be three entrances to the HSR station on the west side of the tracks: a north entrance at the end of White Street and two entrances on Laurel Grove Lane, one north and one south. The aerial station would require viaduct columns within the PG&E substation. The HSR station building would encompass 99,289 square feet with a 4,440-square-foot substation and systems building. The concourse would consist of a mezzanine level above the existing Caltrain tracks and below the HSR platforms, with three east-west connections across the tracks at the north, south, and middle.

Existing station parking spaces displaced permanently would be replaced 1:1 with new parking areas at Cahill and Park Streets and at Stockton and Alameda Streets. If the Google Downtown West proposed development is not realized, then the project would displace some existing SAP parking lot spaces and they would be replaced through a parking area north of Julian Street at the corner of Julian Street and Montgomery Street. If the Google Downtown West proposed development is realized in the SAP Center parking lot, then the Downtown West project would account for displacement of parking spaces in the SAP Center parking lot through its plans, which include a requirement to result overall in a net increase in parking available to the SAP Center by 350 spaces and the HSR project would not include an additional parking area north of Julian Street.

HSR parking demand of 1,050 spaces in 2040 would be met by commercially available parking downtown as well as at the Mineta San Jose International Airport, approximately three miles from the station. The Authority has provided a Station Area Planning grant to the City of San Jose to advance the implementation of the Diridon Station Area Plan adopted by the San Jose City Council. Through this effort, the City would address short-term parking needs during HSR and BART Phase II construction and would also address plans for transitioning the parking needed during construction to the highest and best use after construction. Another Station Area Planning grant to the VTA would fund a San Jose Diridon Station Facilities Master Plan. This grant would be used to develop a parking program to manage parking demand and supply over time to reflect changes in ridership and park-and-ride mode share. These two studies would provide input into a multimodal access plan for the station that would be developed prior to final station design and construction.

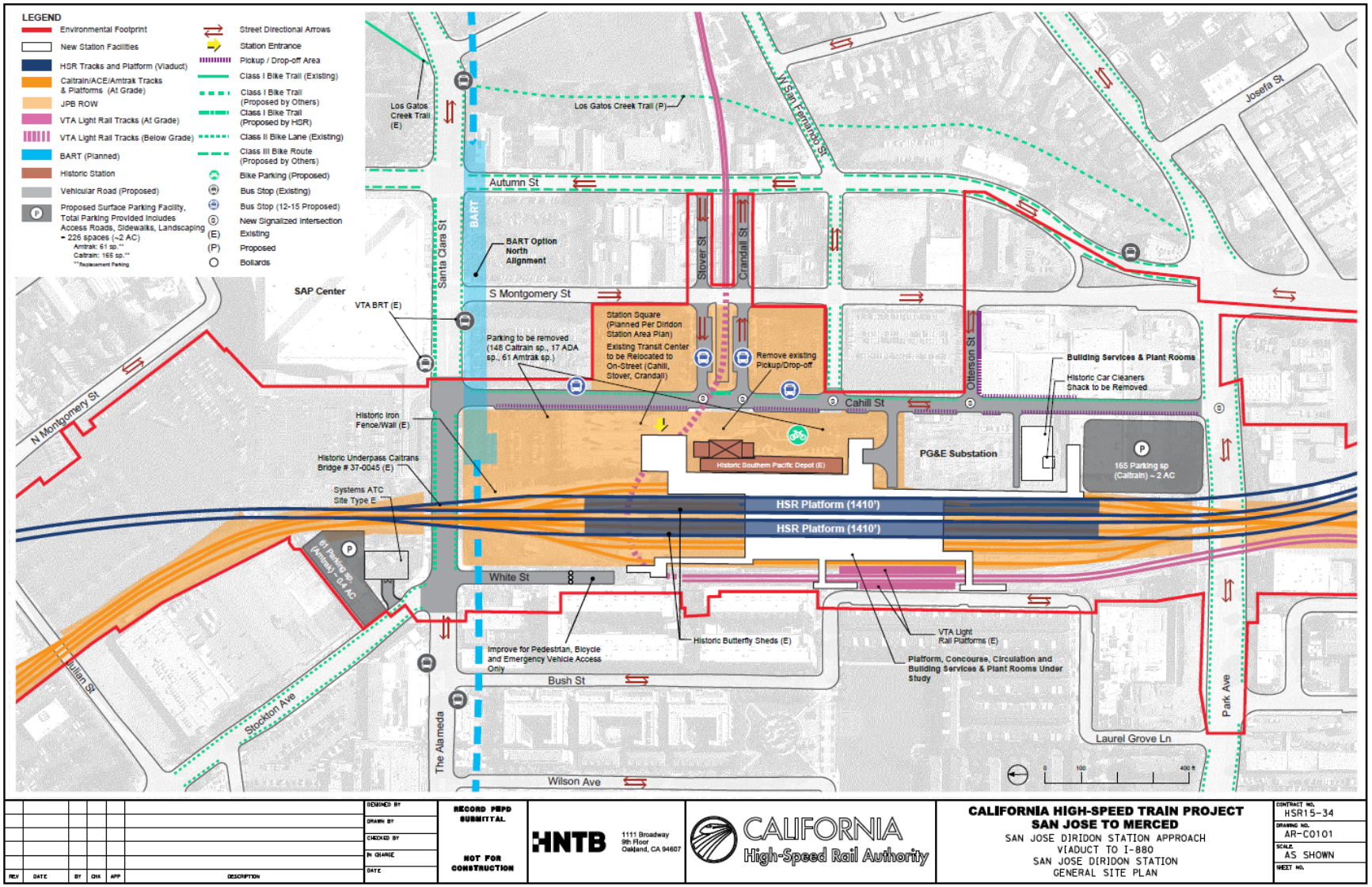
Existing underutilized parking capacity at and around the station would be used to meet the estimated HSR parking demand until a station area parking policy and program are implemented. The Authority would rely on commercially available parking to meet HSR parking demand, provided and priced in accordance with local conditions. HSR riders would be able to walk or take a shuttle, such as the City of San Jose's DASH, from parking downtown or adjacent to the station.

The existing off-site bus transit center would be relocated to an on-street facility on Cahill, Stover, and Crandall Streets. Street improvements would include reconfiguring and extending Cahill Street from Santa Clara Street to Park Avenue, and converting Cahill, Stover, and Crandall Streets to a transit street with 12 to 15 bus stops. Montgomery Street would be reconfigured to provide curb space for a bus layover. A pick-up/drop-off zone of 1,900 square feet would be provided. New two-way cycle tracks would be installed on the east side of Cahill Street. A 4,000-

[11] The PG&E substation is not part of the project footprint.

square-foot bicycle facility would be constructed. New signals and pedestrian crossings would be developed at Cahill and Park, Otterson, Stover, West San Fernando, and Crandall Streets.

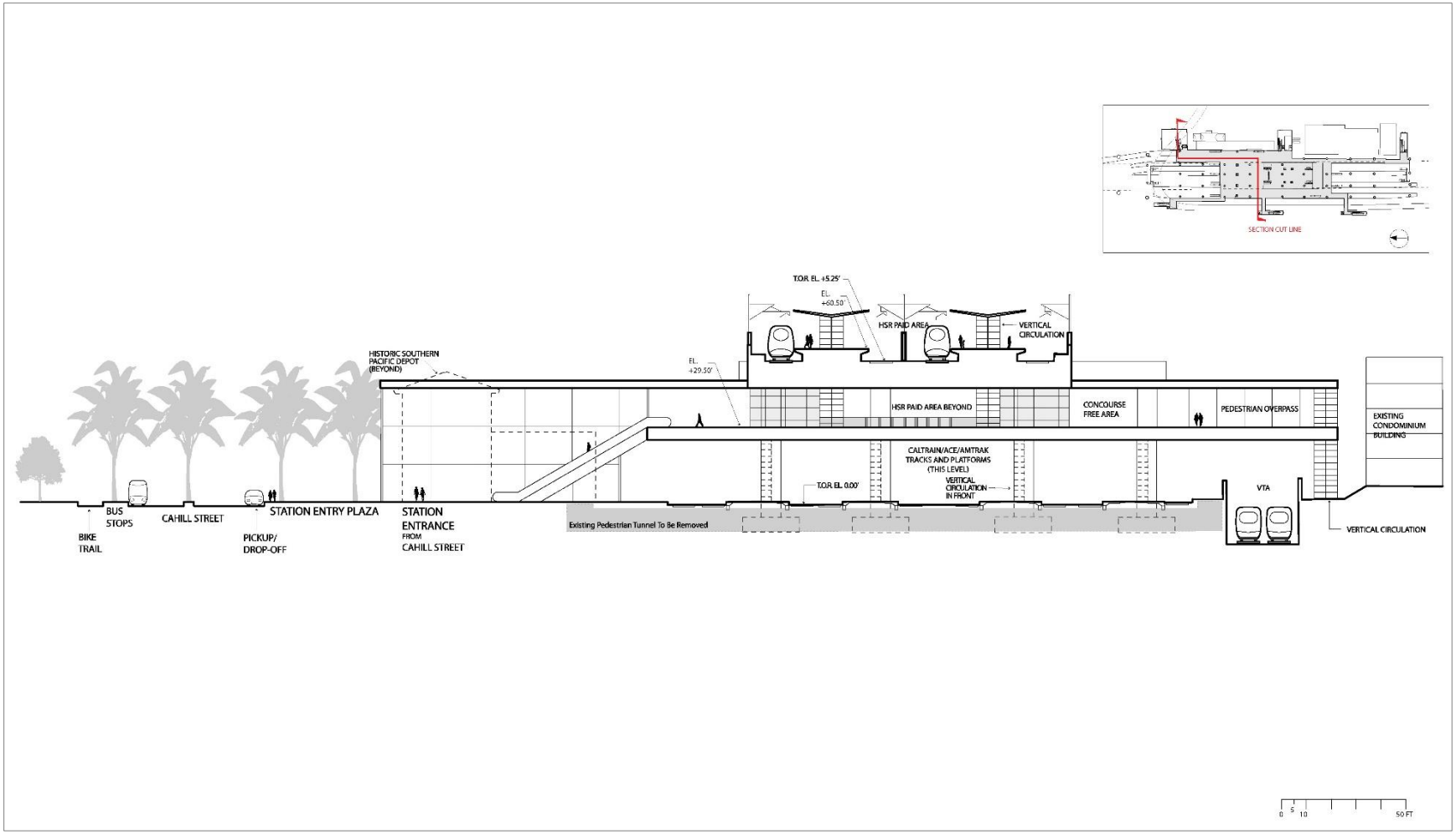
Other rail operators in the station area are Caltrain, ACE, Amtrak, VTA light rail, and future BART. VTA has plans to construct new light rail station platforms as a separate project, and BART plans to extend service from the Berryessa Station to Santa Clara with a stop at the San Jose Diridon Station by 2026.


LEGEND
Environmental Footprint
New Station Facilities
HSR Tracks and Platform (Viaduct)
Caltrain/ACE/Amtrak Tracks & Platforms (At Grade)
JPB ROW
VTA Light Rail Tracks (At Grade)
VTA Light Rail Tracks (Below Grade)
BART (Planned)
Historic Station
Vehicular Road (Proposed)
Proposed Surface Parking Facility, Total Parking Provided Includes Access Roads, Sidewalks, Landscaping - 226 spaces (~2 AC)
Amtrak: 61 sp.**
Caltrain: 165 sp.**
**Replacement Parking
Street Directional Arrows
Station Entrance
Pickup / Drop-off Area
Class I Bike Trail (Existing)
Class I Bike Trail (Proposed by Others)
Class I Bike Trail (Proposed by HSR)
Class II Bike Lane (Existing)
Class III Bike Route (Proposed by Others)
Bike Parking (Proposed)
Bus Stop (Existing)
Bus Stop (12-15 Proposed)
New Signalized Intersection
(E) Existing
(P) Proposed
Bollards
Los Gatos Creek Trail (E)
Los Gatos Creek Trail (P)
W San Fernando St
Josefa St
Autumn St
BART
Santa Clara St
BART Option North Alignment
Slover St
Crandall St
S Montgomery St
SAP Center
VTA BRT (E)
Station Square (Planned Per Diridon Station Area Plan)
Existing Transit Center to be Relocated to On-Street (Cahill, Stover, Crandall)
Parking to be removed (148 Caltrain sp., 17 ADA sp., 61 Amtrak sp.)
Remove existing Pickup/Drop-off
Otterson St
Building Services & Plant Rooms
Historic Car Cleaners Shack to be Removed
Cahill St
N Montgomery St
Historic Iron Fence/Wall (E)
Historic Underpass Caltrans Bridge # 37-0045 (E)
Systems ATC Site Type E
Historic Southern Pacific Depot (E)
PG&E Substation
165 Parking sp (Caltrain) ~ 2 AC
HSR Platform (1410')
HSR Platform (1410')
61 Parking sp (Amtrak) ~ 0.4 AC
White St
Historic Butterfly Sheds (E)
VTA Light Rail Platforms (E)
Improve for Pedestrian, Bicycle and Emergency Vehicle Access Only
Platform, Concourse, Circulation and Building Services & Plant Rooms Under Study
Bush St
Julian St
Stockton Ave
The Alameda
Park Ave
Laurel Grove Ln
Wilson Ave
RECORD PRPD SUBMITTAL
NOT FOR CONSTRUCTION
HNTB
1111 Broadway 9th Floor Oakland, CA 94607
CALIFORNIA High-Speed Rail Authority
CALIFORNIA HIGH-SPEED TRAIN PROJECT
SAN JOSE TO MERCED
SAN JOSE DIRIDON STATION APPROACH
VIADUCT TO I-880
SAN JOSE DIRIDON STATION
GENERAL SITE PLAN
CONTRACT NO. HSR15-34
DRAWING NO. AR-C0101
SCALE AS SHOWN
SHEET NO.

Source: Authority 2019a

JUNE 2019

Figure 2-54 Conceptual San Jose Diridon Aerial Station Plan (Alternatives 1 and 3)



Source: Authority 2019a

JUNE 2019

Figure 2-55 Conceptual San Jose Diridon Aerial Station Cross Section (Alternatives 1 and 3)

Maintenance Facilities

No maintenance facilities are proposed for this subsection.

State Highway or Local Roadway Modifications

The HSR viaduct crossing over the I-280/SR 87 interchange would require construction of a complex, long-span viaduct approximately 70 to 100 feet high (measured from existing ground level to top of rail). Construction activities would entail disturbance of traffic and may require temporary lane closures on the highway and associated ramps for the duration of construction. Proposed viaduct footings would be constructed below the existing freeway, and the viaduct superstructure would be constructed above the freeway. Moreover, the proposed viaduct columns would be constructed adjacent to existing freeway bridges and within the freeway shoulder, median, gore (i.e., split) of I-280, and nearby ramps. Space for HSR construction equipment and materials would be limited by the proximity of these roadway features. The HSR viaduct may also require redesign and reconstruction of existing signage, striping, or other freeway appurtenances. Three straddle bents spanning the platform and tracks are proposed to avoid affecting the existing railroad tracks near Tamien and the Tamien Station platform. The HSR footings and columns would be near the SR 87 freeway and the Lelong Street on-ramp. The footing construction would likely involve temporary closure of the ramp.

Freight or Passenger Rail Modifications

Between Scott Boulevard and Benton Street, HSR would operate on blended service tracks, entailing several minor track modifications of less than 1 foot between Scott Boulevard and I-880. The blended service tracks are owned by the PCJPB. The Santa Clara Station would remain unchanged. Beginning at I-880 on the southward approach to West Hedding Street, Caltrain tracks would be realigned to accommodate the HSR tracks. Dedicated HSR tracks would diverge from the Caltrain MT2 and MT3 and continue south along the east side of the existing Caltrain corridor. The UPRR/Caltrain MT1 tracks would be shifted east by up to 226 feet. College Park Station would have new northbound and southbound platforms and pedestrian undercrossings. The freight track would be shifted up to 64 feet at the Lenzen Wye. Straddle bents would be constructed over the existing Tamien Station.

Land Use and Community Modifications

The HSR facilities in this subsection would be constructed predominantly in the existing Caltrain right-of-way. The HSR alignment would diverge from the Caltrain right-of-way just south of the San Jose Diridon Station along a southeast alignment over the I-280/SR 87 interchange before returning to the Caltrain right-of-way just north of the Tamien Caltrain Station. This alignment would require modifications of some intersections, acquisition of TCEs, and acquisition of permanent right-of-way in some areas along the alignment.

Monterey Corridor Subsection

Alignment and Ancillary Features

The Monterey Corridor Subsection would be approximately 9 miles long and entirely within the San Jose city limits. From the San Jose Diridon Station Approach Subsection at West Alma Avenue just south of the Caltrain Tamien Station, the alignment would extend southeast to Bernal Way. Alternative 1 would be on viaduct in the median of Monterey Road. UPRR MT1, Caltrain MT2, and Caltrain storage tracks would be shifted east between West Alma Avenue and Caltrain/UPRR Control Point (CP) Lick, at the southeast base of Communications Hill. The railroad bridge over Almaden Road and the Almaden Expressway road bridge would be extended to accommodate the track shift. The UPRR Luther spur track south of Almaden Expressway would also be relocated to accommodate the MT shifts.

From West Alma Avenue, the HSR alignment would descend from a viaduct 54 feet high to embankment (i.e., 5 feet or higher) north of Almaden Road. The alignment would continue primarily on embankment to cross over Almaden Road on a short aerial structure, then under Almaden Expressway, then continue south on embankment to at grade under Curtner Avenue.

The alignment would continue south primarily at grade along the northern base of Communications Hill and ascend to aerial structure before crossing over and entering the Monterey Road median just south of Hillsdale Avenue. Construction of the viaduct over the existing Caltrain Capitol Station would require either falsework over the station if constructed by cast-in-place (CIP) methods or relocating the station 500 feet to the south if built using precast segments. The alignment would continue south on viaduct in the median of Monterey Road, crossing over Capitol Expressway, Skyway Drive, Branham Lane, Roeder Road/Chynoweth Avenue, Blossom Hill Highway, SR 85/West Valley Freeway, and Bernal Road.

The design assumes a reduction from six to four travel lanes on Monterey Road, beginning south of Southside Drive and continuing south of Blossom Hill Road, where the existing roadway is already four travel lanes. Three existing mid-block left-turn lanes would be closed because of substandard stopping sight distance. Additionally, the design assumes a combined left-turn and through lane at Palm Avenue.

Traction Power Facilities

Two traction power paralleling stations would be constructed in the subsection:

- North of the alignment near Curtner Avenue or south of the alignment at Communications Hill
- South of SR 85 or between Bernal Road and the Bernal Road ramp onto Monterey Road

Train Control and Communication Facilities

One ATC site would be constructed in the subsection at one of two locations east of the guideway in the vicinity of Chynoweth Avenue.

Three standalone communications radio sites are proposed:

- Near Almaden Road on the east side of Monterey Road (two site options)
- Near Capitol Expressway (two site options)

Wildlife Crossings

There would be no wildlife crossings in this subsection.

Stations

No stations are proposed for this subsection.

Maintenance Facilities

No maintenance facilities are proposed for this subsection.

State Highway or Local Roadway Modifications

Monterey Road between Southside Drive and south of Blossom Hill Road would be narrowed to four lanes. Three mid-block left-turn lanes into shopping centers would be closed. Appendix 2-A details local road modifications that would be required in the Monterey Corridor Subsection.

Freight or Passenger Rail Modifications

Construction in this subsection would require temporary use of areas of UPRR right-of-way for construction staging. UPRR MT1, Caltrain MT2, and Caltrain storage tracks would be shifted east between West Alma Avenue and Caltrain/UPRR CP Lick at the southeast base of Communications Hill. A railroad bridge over Almaden Road and the Almaden Expressway road bridge would be extended to accommodate the track shift. The UPRR Luther spur track south of Almaden Expressway would also be relocated to accommodate the mainline track shifts. An HSR viaduct would cross over UPRR on straddle bents with a minimum vertical clearance of 23.4 feet between stations 304+00 and 309+00. A temporary platform would be installed at the Capitol Station south of the existing platform during construction of the straddle bents supporting the HSR tracks.

Land Use and Community Modifications

HSR would require acquisition of residential, commercial, industrial, and public (Monterey Road corridor) properties in this subsection to obtain adequate right-of-way for construction and operations.

Morgan Hill and Gilroy Subsection

Alignment and Ancillary Features

The Morgan Hill and Gilroy Subsection would be approximately 30 to 32 miles long, continuing south from the Monterey Corridor Subsection. From Bernal Way in South San Jose, the alignment would extend through Morgan Hill and San Martin to the Downtown Gilroy Station, then curve generally east across the Pajaro River floodplain and through a portion of northern San Benito County before entering Tunnel 1 at the base of the Diablo Range. The alignment would exit the tunnel at Casa de Fruta Parkway/SR 152 in unincorporated eastern Santa Clara County, where it would transition to the Pacheco Pass Subsection. This subsection under Alternative 1 would use the Viaduct to Downtown Gilroy design option and an aerial Downtown Gilroy Station.

Beginning at the southern limit of the Monterey Corridor Subsection, the alignment would be on viaduct in the median of Monterey Road. In this four-lane section of the road, the design assumes a combined left-turn and through lane to Palm Avenue. The alignment would begin curving east on viaduct (approximately 40 feet above grade) near Ogier Avenue in Santa Clara County. The northbound lanes of Monterey Road would be realigned at this transition to cross beneath the HSR viaduct between columns of the aerial structure.

After crossing the Coyote Valley on viaduct, the alignment would cross over Burnett Avenue in Morgan Hill and parallel US 101 on the west side of the freeway. Continuing south, the alignment would bypass downtown Morgan Hill by crossing over Cochrane Road and associated freeway ramps, East Main Avenue, East Dunne Avenue and associated freeway ramps, and Tennant Avenue and associated freeway ramps.

South of Tennant Avenue and the Morgan Hill city limits, the alignment would turn west, relocating the cul-de-sac at Fisher Avenue to west of the guideway, then crossing over Maple Avenue, West Little Llagas Creek, East Middle Avenue, and Llagas Creek before rejoining Monterey Road and the UPRR corridor in the community of San Martin. The crossing of Llagas Creek would allow for wildlife movement by clear-spanning both banks and riparian habitat. New storm drainage infrastructure would be constructed on the west side of the alignment along Llagas Creek. The alignment would continue on viaduct along the east side of UPRR and cross over East San Martin Avenue.

South of Las Animas Avenue and the west branch of Llagas Creek, the alignment would curve east over Leavesley Road and Casey Lane. Continuing south, the viaduct would cross the Gilroy Prep School/South Valley Middle School sports field, a portion of the Gilroy Prep School campus, and Upper Miller Slough (with armor added to the channel to strengthen the stormwater conveyance) before crossing over IOOF Avenue, Lewis Street, Martin Street, East 6th Street, and a realigned East 7th Street, to arrive at the Downtown Gilroy Station on low viaduct (approximately 33 feet high).

South of the Downtown Gilroy Station, the alignment would continue on viaduct over East 10th Street. Banes Lane would be reconstructed to provide a standard cul-de-sac. South of the Princevale Channel crossing, the alignment would ascend, still on viaduct, over Luchessa Avenue, US 101, and one UPRR spur track. After branching from the main UPRR track and crossing under the HSR viaduct, the new UPRR track for freight access to the MOWF would travel at grade on the east side of the new HSR track toward the South Gilroy MOWF site. Both the UPRR track and HSR tracks would cross the City of Gilroy wastewater disposal ponds. Continuing south, the HSR alignment would ascend onto embankment. New storm drainage infrastructure would be constructed on the west side of the alignment at Carnadero Avenue, which would be closed where it meets the alignment. Bloomfield Avenue would be realigned to cross over the South Gilroy MOWF site. Sheldon Avenue would become a cul-de-sac south of the

HSR alignment and would be abandoned north of the HSR alignment. Before crossing the Pajaro River, the alignment would ascend onto viaduct.

The HSR alignment south and east of Gilroy would cross an agricultural area in Santa Clara and San Benito Counties that is part of the upper Pajaro River floodplain, historically referred to as Soap Lake. The HSR guideway would be on viaduct over the major watercourses to provide a floodplain crossing that is neutral to the hydrology and hydraulics of the floodplain and to accommodate wildlife movement. Because of the Calaveras fault crossing at this location, Tequesquita Slough would be partially filled by approximately 800 feet of HSR embankment. The embankment area would include cross-culverts and 1.3 acres of adjacent floodwater detention basins; in addition, an extended viaduct over Pacheco Creek would serve to maintain floodplain capacity and function. HSR would be on embankment between Pacheco Creek and Lovers Lane, returning to viaduct at Lovers Lane. After Lovers Lane, the alignment would continue in a combination of embankment and viaduct until reaching the west portal for Tunnel 1 on the east side of SR 152. After exiting the 1.4-mile Tunnel 1 on the west side of SR 152, the alignment would cross over SR 152 and the southern portion of the Pacheco Creek Valley on an aerial structure south of Casa de Fruta. The Tunnel 1 design variant would be in the same horizontal and vertical location as Tunnel 1, but it would have a greater superelevation[12] in the curves to allow speeds up to 220 mph in the tunnel and tunnel approaches. The alignment would transition onto embankment just beyond Southside Way at the western transition to the Pacheco Pass Subsection.

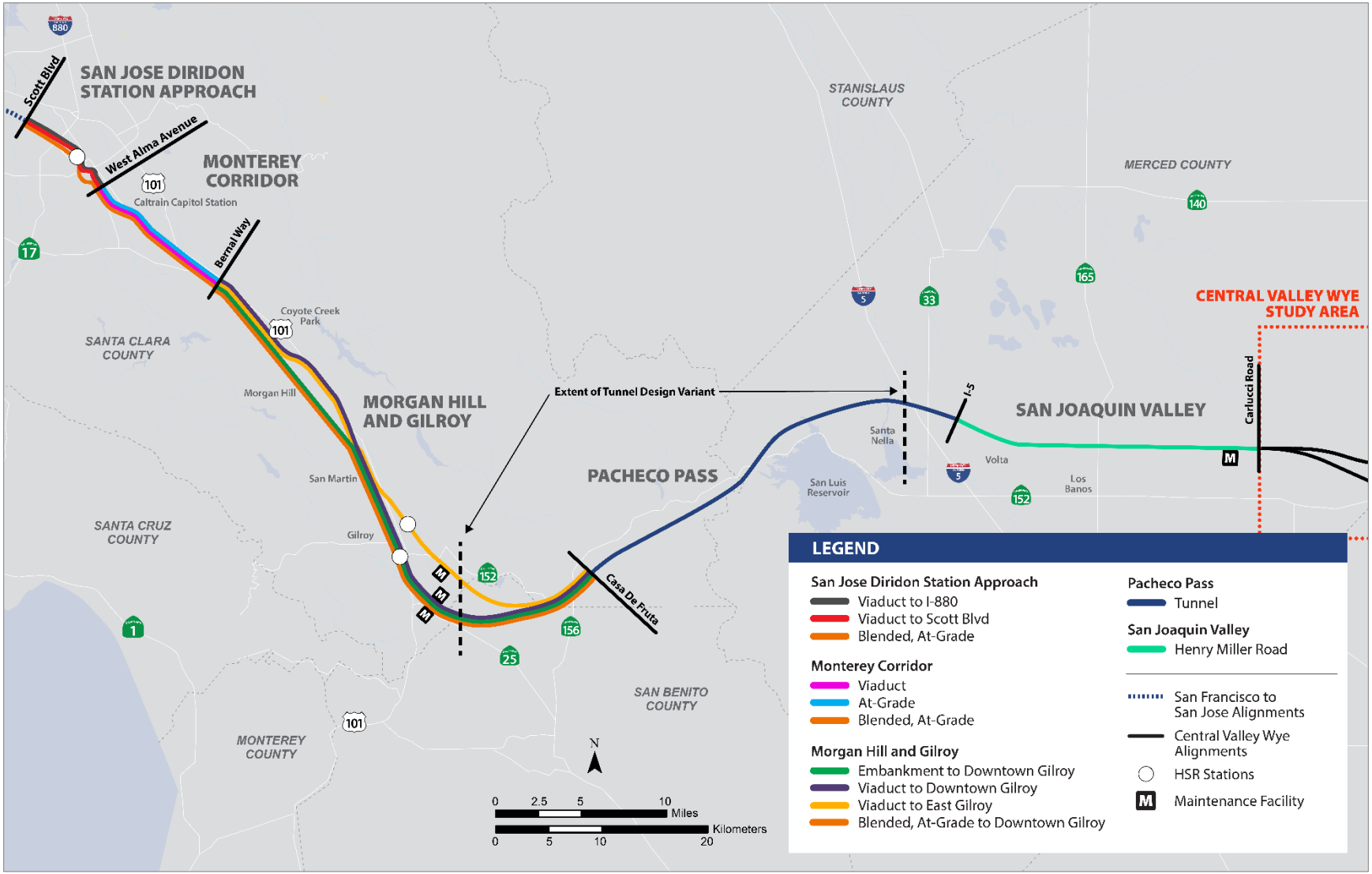
Tunnel Design Variant

The TDV consists of alterations to all the alternatives (i.e., as compared to the base preliminary designs in Volume 3) of the tunnel and tunnel approaches in the Morgan Hill and Gilroy Subsection (Tunnel 1) and the tunnel and tunnel approaches in the Pacheco Pass Subsection (Tunnel 2) to accommodate an operating speed of 220 mph. Accordingly, the TDV consists of physical changes (described in the next paragraph) and operational changes (i.e., increased speed in the tunnels and the tunnel approaches from 200 mph to 220 mph).

The TDV would not change the horizontal alignment through the tunnels. The superelevation of tracks approaching and through both tunnels would be increased to accommodate the faster operating speeds. The TDV would flatten a set of vertical curves inside Tunnel 2. The locations of the vertical curves are near the highest subsurface location within Tunnel 2. The changes to the vertical curves would modestly increase tunnel depth compared to the Tunnel 2 design of the project alternatives without the TDV. The TDV would also require a minor increase in internal diameter of Tunnel 1 from 28 feet to 28.5 feet. Since the Tunnel 1 and Tunnel 2 location and design are equivalent across Alternatives 1 through 4, these changes could be applied to any of the alternatives.

In addition, the TDV would increase spiral lengths on two horizontal curves south of Highway 101 in the vicinity of the MOWF under Alternatives 1, 2 and 4, which would result in a minor shift in horizontal alignment (less than 2.5 feet) under those alternatives. The alignment change would not change the right of way as currently proposed. Alternative 3 currently meets the geometric requirements for the higher speed north of the tunnels.The rationale for the preliminary tunnel designs of the alternatives without the TDV was to reduce the cost of the construction of the tunnels by reducing the tunnel diameter, despite the speed limitation (Authority 2016d). The Authority has developed the TDV to provide design speeds of 220 mph and has identified how it can achieve speeds without increasing the tunnel diameter so that costs of construction are the same. The location of the TDV is identified on Figure 2-56.

[12] *Superelevation* is the vertical distance between the height of the inner and outer rails at a curve. Superelevation is used to partially or fully counteract the centrifugal force acting radially outward on a train when it is traveling along the curve.



Source: Authority 2019a

MARCH 2020

Figure 2-56 Extent of Tunnel Design Variant

Traction Power Facilities

One new TPSS, Site 4—Gilroy, would be constructed at one of two alternate locations on the north side of the alignment: east or west of Bloomfield Avenue. At this site, one new PG&E switching station could be co-located with the TPSS. Communication facilities (i.e., redundant fiber optic [two underground or one underground and one overhead on existing power structures] lines) would also be required to support the electrical interconnections connecting the TPSS to a new utility switching station, to existing PG&E facilities, or both, typically within tie-line/utility corridors.

North of Site 4—Gilroy, a traction power switching station would be constructed east of the HSR alignment at a location north of Palm Avenue.

Four traction power paralleling stations would be constructed adjacent to the guideway at the following locations:

- South of the alignment, either south of Diana Avenue or at the intersection of San Pedro Avenue and Walnut Grove Drive
- North of the alignment, either south of Masten Avenue or south of Rucker Avenue
- In the vicinity of Lovers Lane, either south of the alignment and west of Lovers Lane or north of the alignment and west of Lovers Lane
- At the Tunnel 1 east portal

PG&E would reinforce the electric power distribution network to meet HSR traction and distribution power requirements by replacing (reconductoring) the 9.8-mile Metcalf to Morgan Hill and the 10.8-mile Morgan Hill to Llagas 115 kV power lines. The existing power lines to be reconductored, reusing the poles and towers, begin at the Metcalf Energy Center in San Jose and continue southeast parallel to the alignment on the east side before crossing to the west side near Ogier Avenue. Continuing on the west side to the Morgan Hill Substation on West Main Avenue in Morgan Hill, the lines then cross the east side of Peak Avenue and Dewitt Avenue, spanning West Dunne Avenue, Chargin Drive, Spring Avenue, and several residences. The alignment would continue south across an open space area, then follow Sunnyside Avenue for approximately 0.5 mile. The alignment would continue south for approximately 4 miles, spanning additional open space areas of wineries and the Corde Valle Golf Course. The alignment would then turn east along the north side of Day Road before heading south for approximately 2.5 miles and terminating at the Llagas Substation in Gilroy. Reconductoring at Metcalf Energy Center in San Jose would be required as well.

A permanent overhead distribution line from TPSS Site 4 to the Tunnel 1 portal location would provide power to the tunnel boring machine (TBM) during construction and the tunnel fire-life-safety system during operation.

There are alternative sites for power drops at both portals for Tunnel 1. At each portal, one site is north of the alignment and one is south.

Train Control and Communication Facilities

A total of 19 ATC sites would be constructed in the Morgan Hill and Gilroy Subsection for this alternative:

- One site east of Monterey Road near Palm Avenue (two site options)
- One site at East Middle Avenue (two site options)
- One site between Las Animas Avenue and Leavesley Road
- One site south of Leavesley Road
- One site south of Lewis Street
- One site north of 6th Street in Gilroy
- Two sites south of 6th Street in Gilroy
- Two sites north of 10th Street in Gilroy

- One site south of Banes Lane
- Five sites north of Carnadero Avenue
- Three sites east of the Pajaro River
- One site near Lake Road (two site options)

Six standalone communication radio sites would be constructed in this subsection:

- Forsum Road or Blanchard Road (two site options)
- Near Bailey Avenue (two site options)
- Between Barnhart Avenue and Kirby Avenue (two site options)
- South of Cochrane Road along US 101 (two site options)
- North of Cox Avenue and south of West San Martin Avenue (two site options)
- East of the Pajaro River, south of Gilroy

Wildlife Crossings

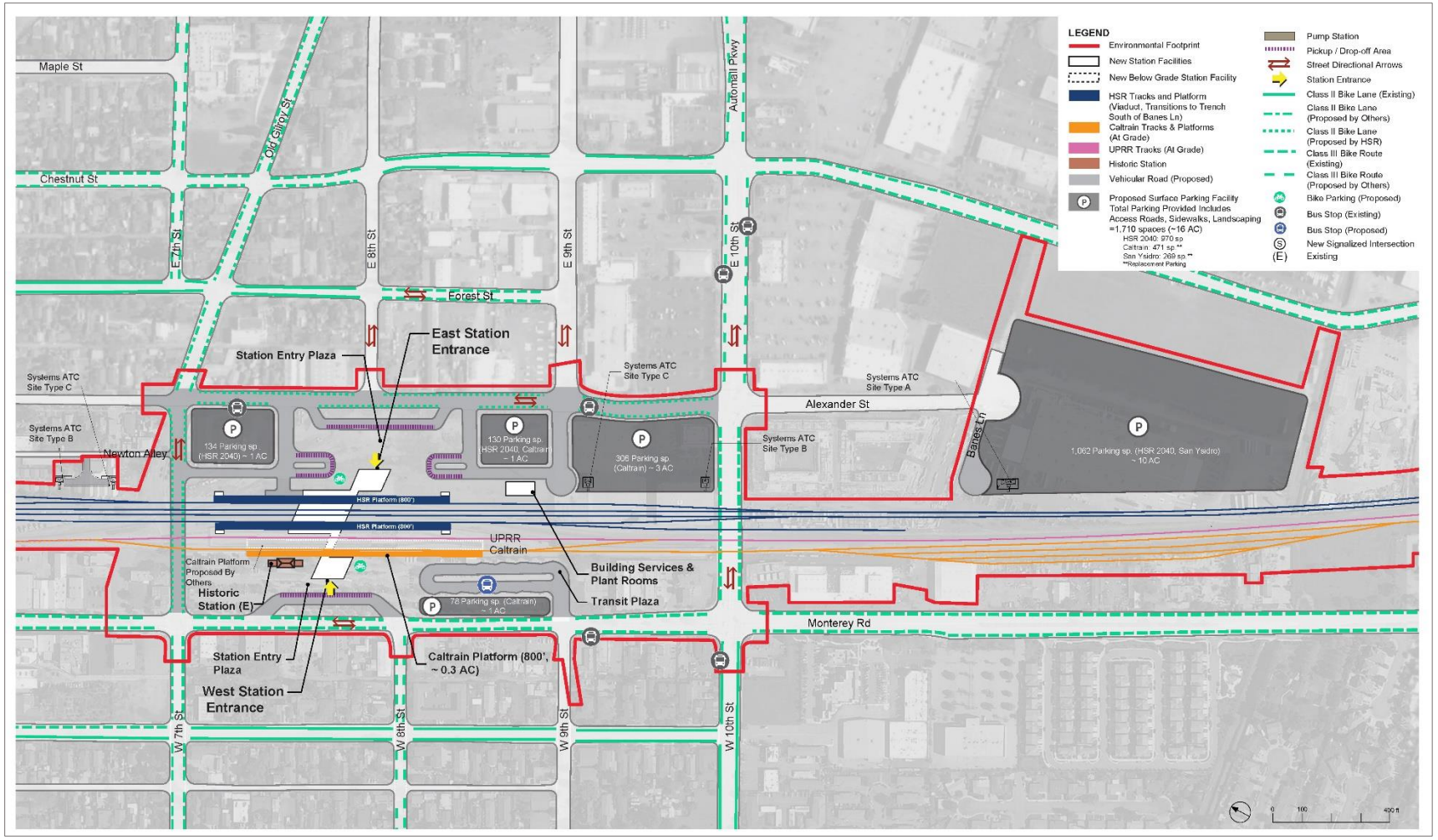
Three wildlife crossings would be provided at the base of Tulare Hill north of the Metcalf Substation connecting to Coyote Creek. The existing culvert under Monterey Road at Fisher Creek would be realigned and replaced with a larger box culvert to improve wildlife movement under Monterey Road and the HSR track. The crossing of Llagas Creek would allow for wildlife movement by clear-spanning both banks and riparian habitat. The alignment would be primarily on viaduct through the Soap Lake area to allow for wildlife movement. Viaducts have heights, widths, and depths considered to be very favorable for wildlife movement.

Stations

The Downtown Gilroy station under Alternative 1 is estimated to have 6,210 boardings in 2040. The new HSR station would be constructed south of the existing Caltrain station. The station approach would be on a low viaduct—approximately 33 feet to top of rail—with dedicated HSR tracks east of UPRR between relocated Old Gilroy/7th Streets and 9th Street. The 800-foot platforms would be on the east and west sides of the HSR tracks. The new HSR station building would have both east and west entrances: the main entrance for passengers arriving by auto or bicycle would be on the east side while the main entrance for passengers arriving on foot or by transit would be on the west side. The HSR station building would encompass 60,513 square feet with a 4,400-square-foot substation and systems building. The concourse would be below the new HSR tracks.

The existing 471 Caltrain parking spaces on the west side of the station would be replaced 1:1 by either reconfiguring parking on the west side of the station or relocating it to the east side of the station. The existing 269 San Ysidro housing development parking spaces would be replaced 1:1 with new surface parking at the south end of Alexander Street. HSR 2040 parking demand would be 970 spaces. The station site plan provides 970 new parking spaces in five areas, for a total of 1,710 parking spaces in 2040. One site would be west of the station along Monterey Road at 9th Street. The other four would be east of the station along Alexander Avenue at 7th Street, 9th Street, 10th Street, and Banes Lane. A multimodal access plan would be developed prior to design and construction of the station. The plan would be developed in coordination with local agencies and would include a parking strategy that would confirm the location, amount, and phasing of parking.

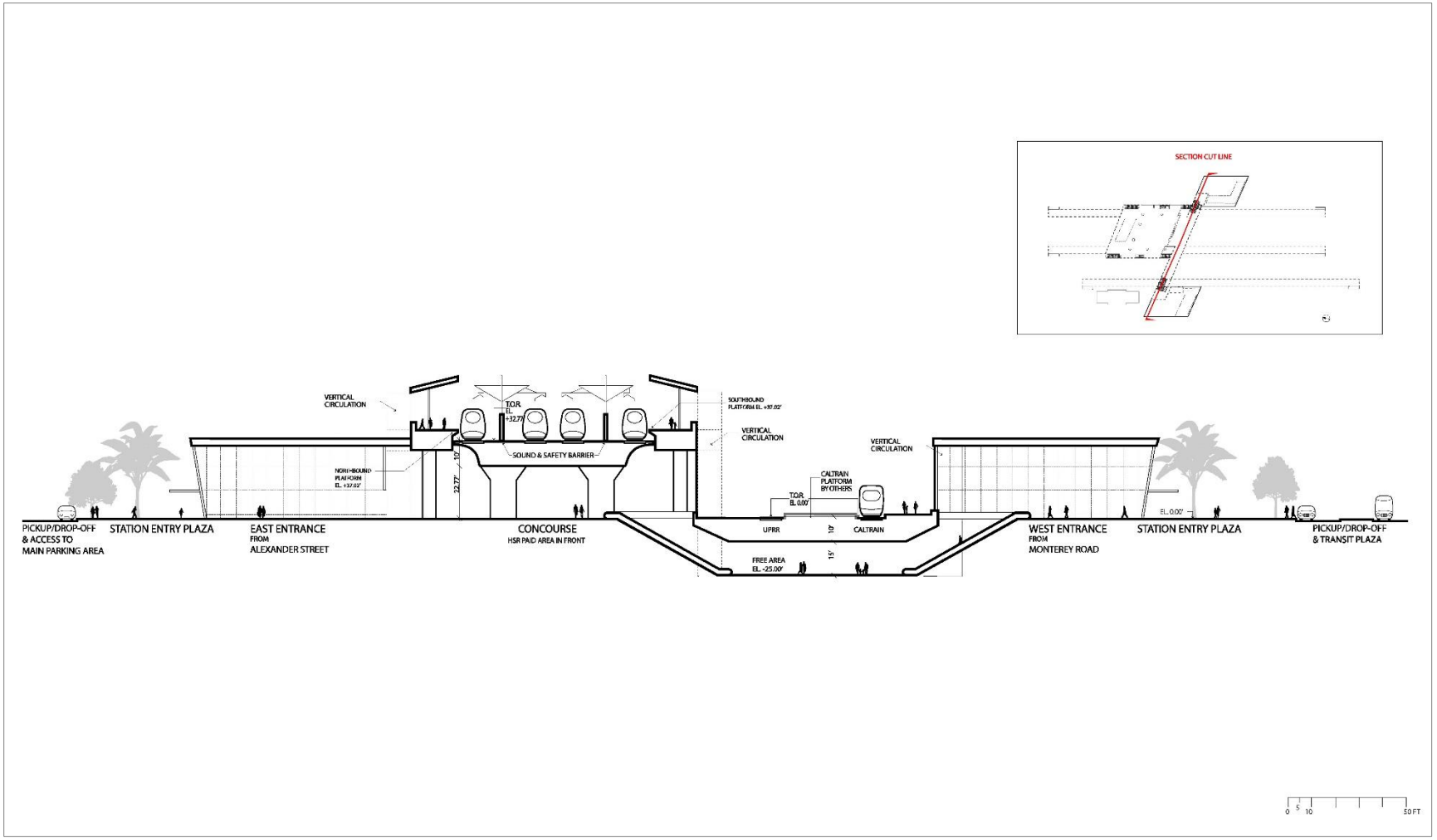
A total of eight bus bays would be provided. Street improvements would include realignment of Old Gilroy Street at East 7th Street; existing grade crossings would remain unchanged. A 4,000-square-foot bicycle facility would be built. Class II bike lanes would be provided on 7th and Alexander Streets (Figure 2-57 and Figure 2-58).



Source: Authority 2019a

JUNE 2019

Figure 2-57 Conceptual Downtown Gilroy Aerial Station Plan (Alternative 1)



Source: Authority 2019a

JUNE 2019

Figure 2-58 Cross Section of Downtown Gilroy Aerial Station (Alternative 1)

Maintenance Facilities

The MOWF under Alternative 1 would be in south Gilroy between Carnadero Road and Bloomfield Road to accommodate machinery and inspection and maintenance staff. The MOWF would encompass approximately 75 acres. The freight connection would be provided as described in the discussion of the alignment and ancillary features. Most of the area would be for storage of rail vehicles on tracks parallel to the HSR mainline. The MOWF would be expected to employ approximately 150 people. Figure 2-42 illustrates the conceptual site plan for the MOWF.

State Highway or Local Roadway Modifications

Appendix 2-A details local road modifications that would be necessary in the Morgan Hill and Gilroy Subsection.

Freight or Passenger Rail Modifications

Construction in this subsection would require temporary use of areas of UPRR right-of-way for construction staging. Permanent modifications would occur at the following locations:

- South of North Avenue to South Street, UPRR right-of-way would be on either side of the HSR right-of-way, with the UPRR tracks to the south of HSR.
- South of Highland Avenue to Day Road, slivers of UPRR right-of-way would be required.
- South of Lewis Street through the downtown Gilroy station to 10th Street, UPRR right-of-way would be required for track realignment and station construction.
- From 6th Street to US 101.
- South of US 101 for a shifted UPRR siding track.
- Freight connection from UPRR to the MOWF.

Land Use and Community Modifications

Alternative 1 would require acquisition of residential, commercial, industrial, and park and recreation properties to obtain adequate right-of-way for construction and operations.

Pacheco Pass Subsection

Alignment and Ancillary Features

The Pacheco Pass Subsection would be approximately 25 miles long. The alignment would generally follow the existing SR 152 corridor east from Casa de Fruta for approximately 17 miles, then diverge north around the Cottonwood Creek ravine of the San Luis Reservoir for approximately 8 miles before transitioning to the San Joaquin Valley Subsection near I-5 in Merced County. Tunnel is the only design option in this subsection.

Landslide or Landslip Areas

Areas subject to the downward falling or sliding of a mass of soil, detritus, or rock on or from a steep slope.

From the eastern limit of the Morgan Hill and Gilroy Subsection, the guideway would transition from aerial structure to embankment along the southern boundary of Casa de Fruta. This stretch of embankment would be on fill or in excavated hillside cuts to accommodate a level HSR guideway profile over varied surface elevations and to control unstable slopes known for vulnerability to landslip (i.e., areas subject to the downward falling or sliding of a mass of soil, detritus, or rock on or from a steep slope). The alignment would ascend to viaduct over Pacheco Creek along the south side of SR 152 and remain on viaduct to the Tunnel 2 west portal. This portal would include a staging area for tunnel construction and a permanent area for traction and facility power with access provided by a service road from SR 152. Tunnel 2 would extend approximately 13.5 miles northeast. Access to the Tunnel 2 east portal for HSR construction, operations, and maintenance would be on McCabe Road north of Romero Ranch. Continuing east, the HSR guideway would be predominantly on a combination of embankment and aerial structures, with viaducts over Romero Creek and the California Aqueduct. Romero Road would be realigned at its intersection with I-5. East of I-5, the

alignment would cross over SR 33/Santa Nella Road and the Central California Irrigation District (CCID) Outside Canal before transitioning to the San Joaquin Valley Subsection at Fahey Road. The Tunnel 2 design variant would be in the same horizontal location as the preliminary design, and the tunnel would be slightly deeper below the surface. It would also have a greater superelevation in the curves, providing for increased speeds up to 220 mph in the tunnel and tunnel approaches.

Tunnel Design Variant

The characteristics of the TDV in the Pacheco Pass Subsection under Alternative 1 would be the same as described in the Morgan Hill and Gilroy Subsection under Alternative 1.

Traction Power Facilities

One new TPSS, Site 5—O'Neill, would be constructed approximately 1.2 miles west of the California Aqueduct. A new 230-kV double-circuit tie-line would be constructed from the expanded Quinto switching station to the TPSS, paralleling an existing PG&E transmission line for approximately 0.6 mile. The tie-line would be installed either underground in a utility easement or overhead, requiring the existing 500-kV transmission line to be raised. No reinforcements to the PG&E power system would be required for this site. Communication facilities (i.e., redundant fiber optic lines) would also be required to support the electrical interconnection. The interconnection would link the TPSS to a new PG&E switching station, to existing PG&E facilities, or both—typically within tie-line/utility corridors.

A traction power switching station would be constructed at each Tunnel 2 portal. A power drop site would be co-located with the switching stations. A new permanent distribution power line from the Quinto switching station along McCabe Road to the Tunnel 2 east portal location would provide power for tunnel construction and fire and life safety systems during operations. The existing PG&E 230-kV Quinto switching station would be expanded within the fence line to support the HSR system.

Traction power paralleling stations would be constructed at three locations:

- Two stations within Tunnel 2 cross passages, approximately 5 miles apart;
- One station either southeast or northwest of the alignment crossing of Fahey Road.

Train Control and Communication Facilities

Three ATC sites would be constructed in the Pacheco Pass Subsection at the following locations:

- West portal of Tunnel 2
- Underground within the limits of Tunnel 2
- Adjacent to TPSS Site 5

One standalone communication radio antenna site would be constructed in the Pacheco Pass Subsection:

- Near SR 152 and the Tunnel 2 west portal

Wildlife Crossings

Four wildlife crossing culverts would be provided west of the California Aqueduct, with an additional two between the California Aqueduct and the Delta-Mendota Canal and one between the Delta-Mendota Canal and I-5. Three wildlife crossings would be provided between I-5 and Santa Nella Road, and three more between Santa Nella Road and Fahey Road. Viaducts would also function as wildlife movement areas in this subsection.

Stations

No stations are proposed for this subsection.

Maintenance Facilities

No maintenance facilities are proposed for this subsection.

State Highway or Local Roadway Modifications

SR 152 would be modified to allow for construction traffic, including road widening, an additional turnout and transition lane on westbound SR 152, and an additional left turn lane and transition lane on eastbound SR 152. The additional lanes would provide queuing space for vehicles going from SR 152 to the west portal of Tunnel 2 and a TPSS site. These modifications would permanently provide access to HSR facilities. Appendix 2-A details local road modifications that would be necessary in the Pacheco Pass Subsection.

Freight or Passenger Rail Modifications

No freight or passenger rail modifications would be required in this subsection.

Land Use and Community Modifications

Alternative 1 would require acquisition of residential, commercial, and industrial properties in this subsection to obtain adequate right-of-way for construction and operations.

San Joaquin Valley Subsection

Alignment and Ancillary Features

The San Joaquin Valley Subsection would be approximately 18 miles long, from east of I-5 (at Fahey Road) to the intersection of Henry Miller Road and Carlucci Road in Merced County, where the alignment would connect to the Central Valley Wye. The single design option in this subsection is Henry Miller Road—a combination of viaduct and embankment.

South of Fahey Road, the guideway would continue east and cross over three irrigation ditches, Cherokee Road, the CCID Main Canal, two additional irrigation ditches, and adjacent farmland on viaduct. Continuing east, the alignment would be on embankment (including four proposed culvert crossings for irrigation ditches) before ascending on an approximately 1.4-mile-long viaduct over the San Luis Wasteway, the UPRR West Side branch line, and Ingomar Grade Road.

The alignment would descend to embankment west of Volta Road while turning southeast before crossing to the south side of Henry Miller Road. Henry Miller Road would be realigned to pass over the HSR alignment on a bridge. The HSR embankment between the Volta Road overcrossing and Los Banos Creek would cross over two proposed culverts to maintain irrigation canals. The alignment would then ascend to cross over Los Banos Creek and Badger Flat Road on a 1.35-mile-long viaduct before descending onto embankment.

The alignment would continue east for 3.6 miles on embankment over several combined wildlife crossing/drainage culverts and drainage culverts, including an irrigation ditch at Wilson Road, an irrigation ditch at Johnson Road, two irrigation ditches at Nantes Avenue, the Santa Fe Canal, the San Luis Canal, the San Luis Drain, and the Porter-Blake Bypass. A road would be constructed between Badger Flat Road and Nantes Avenue. SR 165/Mercey Springs Road would be raised to cross over the HSR alignment and Henry Miller Road on a bridge. East of SR 165 and the Santa Fe Grade, the alignment would ascend to an approximately 1.8-mile viaduct south of the Los Baños State Wildlife Area across Mud Slough to maintain wildlife movement within the GEA. Baker Road, Midway Road, and Hereford/Salt Slough would be closed south of Henry Miller Road. Box Car Road would become a cul-de-sac with a new road to the east. Hutchins Road would be abandoned. The alignment would continue on embankment to the eastern limit of the subsection and the project. Culvert crossings would be provided for the San Pedro Canal, Boundary Drain, Longe Tree Canal, Devon Drain, West Delta Drain, West Delta Canal, Dambrosia Ditch, Delta Canal and seepage drain, East Delta Canal, Poso Drain, Belmont Drain, Delta Canal #1, West San Juan Drain, San Juan #1, and several other irrigation ditches and drains in the section of viaduct over the GEA. Several local roadways—Delta Road, Turner Island Road, and Carlucci Road—would be elevated over the HSR guideway, maintaining access to adjacent properties. The alignment would transition to the Central Valley Wye at Carlucci Road.

Traction Power Facilities

A traction power switching station would be constructed on the north or south side of the alignment at one of two alternate sites east of the intersection of Henry Miller Road and Santa Fe Grade.

Traction power paralleling stations would be constructed at the following locations:

- Either east or west of the Henry Miller Road overcrossing of the HSR alignment near Volta Road (two site options)
- Intersection of Henry Miller Road and Box Car Road (two site options either north or south of the alignment)

Train Control and Communication Facilities

Five ATC sites would be constructed in the San Joaquin Valley Subsection:

- One site east of the CCID Main Canal (two options)
- Three sites near Johnson Road
- One site near Box Car Road (two site options)

One standalone communication radio site would be constructed at Wilson Road (two site options: one east of the San Pedro Canal and one at Carlucci Road).

Wildlife Crossings

The rail alignment would be primarily on viaduct where it overlaps with the GEA boundary and modeled wildlife movement corridors. Three additional wildlife crossing culverts would be added between Fahey Road and Cherokee Road. Regularly spaced wildlife crossing culverts would continue through the remainder of this subsection. In total, there would be 64 wildlife crossings in this subsection.

Stations

No stations are proposed for this subsection.

Maintenance Facilities

An MOWS is proposed near Turner Island Road near the eastern limit of the project. The MOWS would be about 0.5 mile long, encompassing about 4 acres. The facility would be constructed near Henry Miller Road to avoid the GEA and other sensitive habitat.

State Highway or Local Roadway Modifications

Appendix 2-A details local road modifications that would be necessary in the San Joaquin Valley Subsection.

Freight or Passenger Rail Modifications

No freight or passenger rail modifications would be required in this subsection.

Land Use and Community Modifications

Alternative 1 would require acquisition of land in residential, commercial, or agricultural uses to obtain adequate right-of-way for construction and operations. The alignment would traverse a portion of the GEA, requiring acquisition of land under conservation easement.

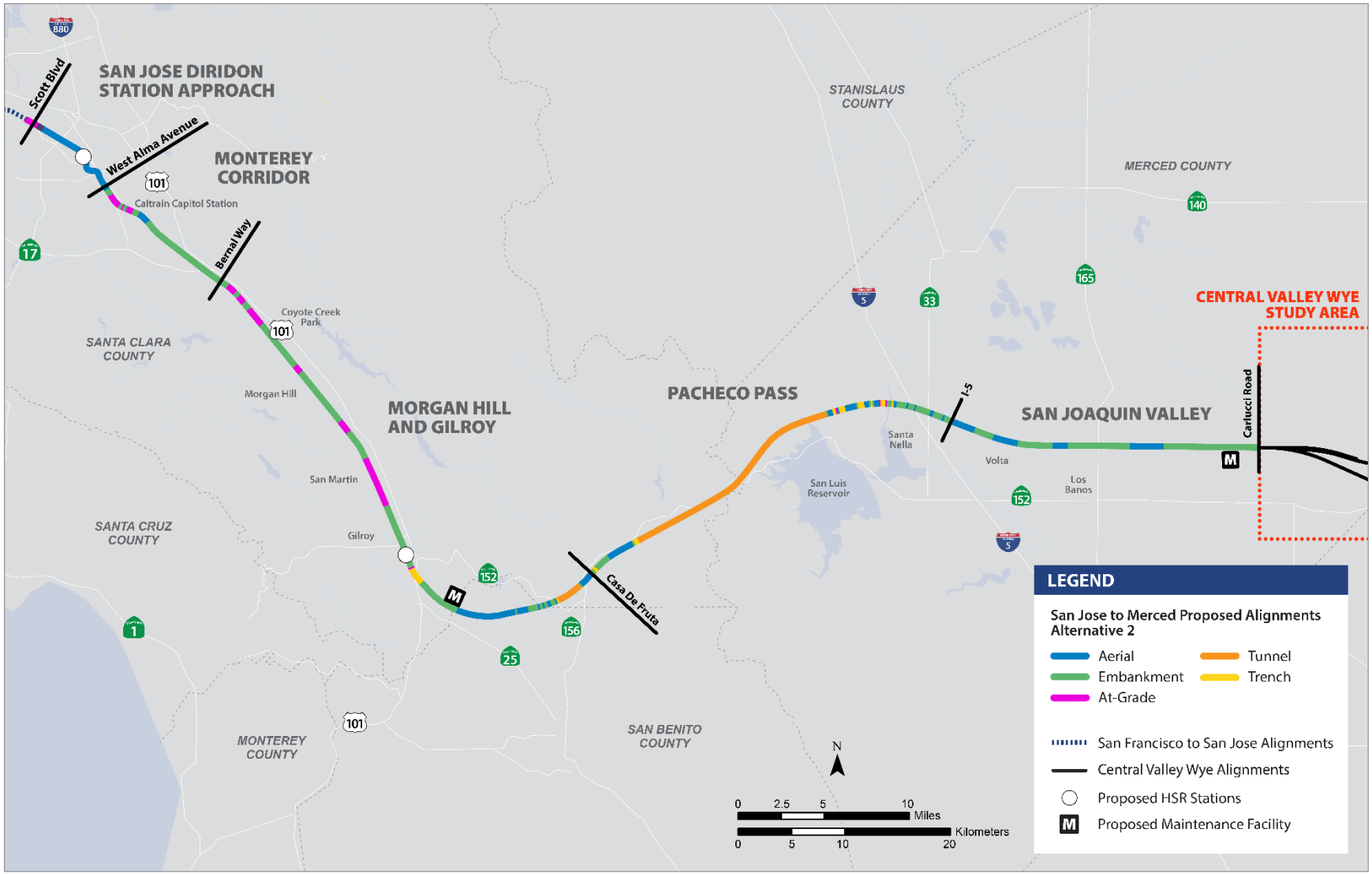
2.6.2.5 Alternative 2

Rationale

Alternative 2 is the alternative that most closely approximates the alignment and structure types identified in the prior program-level documents, implemented by limiting longitudinal encroachment into the UPRR right-of-way to combine railroad grade separations with minimum property displacements. The alignment most closely follows the existing UPRR and Monterey Road transportation corridor. The San Jose Diridon Station Approach Subsection under Alternative 2 would use a longer viaduct, ascending to aerial structure near Scott Boulevard rather than ascending to aerial structure south of I-880. A result of the longer viaduct is that blended service with Caltrain would occur north of Scott Boulevard. The alignment would be at grade through the Monterey Corridor Subsection and through Morgan Hill, and on embankment on approach and through Gilroy, maintaining a lower profile than the viaduct structures under Alternatives 1 and 3 through these areas.

Alternative 2 would operate on a dedicated viaduct from Scott Boulevard through the San Jose Diridon Station Approach Subsection. The alternative would be predominantly at grade east of the UPRR alignment through the Monterey Corridor Subsection, continuing at grade east of UPRR through Morgan Hill to an embankment approach to the downtown Gilroy station through the Morgan Hill and Gilroy Subsection. Like Alternative 1, Alternative 2 would include a South Gilroy MOWF, continuing predominantly on viaduct and embankment across the Soap Lake floodplain before entering Tunnel 1 west of Casa De Fruta. The alignment and guideway in the Pacheco Pass and San Joaquin Valley Subsections would be the same as under Alternative 1.

Overall, this alternative would be comprised of 20.9 miles on viaduct, 8.5 miles at grade, 41.0 miles on embankment, two tunnels totaling 15.0 miles, and 3.2 miles in trench. Figure 2-59 illustrates Alternative 2.



Source: Authority 2019a

JUNE 2019

Figure 2-59 Alternative 2 Proposed Alignment

San Jose Diridon Station Approach Subsection

Alignment and Ancillary Features

Alternative 2 would begin at Scott Boulevard at grade in blended service with Caltrain. Approximately 300 feet south of Scott Boulevard, the HSR tracks would separate from the Caltrain tracks and begin ascending to embankment and then to the 50-foot-tall dedicated viaduct at Main Street. The long viaduct under Alternative 2 would have a wider footprint than the short viaduct to I-880 under Alternative 1, requiring more curve straightening of the Caltrain tracks north of I-880. At the Lafayette Street crossing, the project would replace the existing pedestrian overpass with an underpass. The existing De La Cruz Boulevard overcrossing would be replaced with an undercrossing to enable the HSR aerial structure to cross 43 feet high over De La Cruz Boulevard, the relocated UPRR MT1 and two industry tracks, and the Caltrain Santa Clara Station. The Santa Clara Station northbound platform would be reconstructed to accommodate the supports for the HSR aerial structure. South of Santa Clara Station, the three relocated UPRR tracks would cross under the HSR viaduct so that all Caltrain and UPRR tracks would be west of the HSR viaduct. The viaduct would then ascend to approximately 68 feet to cross over I-880.

Farther south, the existing West Hedding Street roadway overcrossing would be replaced by an undercrossing under the rail corridor. A short section of retained fill would be used to support the tracks over the future BART to San Jose tunnel. The intersection of Stockton Avenue and University Avenue would be replaced by cul-de-sacs. Emory Street would be a new cul-de-sac on the north side of HSR. The curve from westbound West Taylor Street to northbound Chestnut Street would be realigned for the HSR crossing over West Taylor Street; the alignment would then ascend to cross over Cinnabar Street. The UPRR Warm Springs Subdivision Lenzen Wye would be relocated to the southwest. North Montgomery Street would be extended to Cinnabar Street to maintain property access beneath the 68-foot-high HSR viaduct. The alignment would curve west toward the UPRR/Caltrain MTs before crossing over the western part of the SAP Center parking lot, then over West Santa Clara Street to enter the new dedicated HSR aerial platforms at the San Jose Diridon Station. Between San Jose Diridon Station and the transition to the Monterey Corridor Subsection at West Alma Avenue, Alternative 2 would be identical to Alternative 1.

Traction Power Facilities

One new TPSS would be constructed on the east side of the Caltrain corridor as described for Alternative 1 on the south side of I-880.

Train Control and Communication Facilities

Alternative 2 would have six ATC sites within this subsection:

- One site at Scott Boulevard
- One site at Main Street
- One site just north of the San Jose Diridon Station

South of San Jose Diridon Station, the ATC sites would be the same as under Alternative 1: three sites between Park Avenue and the proposed HSR crossing of SR 87.

No standalone communications radio sites would be located within this subsection.

Wildlife Crossings

There would be no wildlife crossings in this subsection.

Stations

The HSR San Jose Diridon Station would be constructed as described for Alternative 1.

Maintenance Facilities

No maintenance facilities are proposed for this subsection.

State Highway or Local Roadway Modifications

Appendix 2-A details local road modifications that would be required in the San Jose Diridon Approach Subsection.

Freight or Passenger Rail Modifications

Two new bridges would be constructed over UPRR and Caltrain at De La Cruz. Caltrain would be relocated between south of Scott Boulevard and I-880. The UPRR tracks would be relocated south of De La Cruz to pass around the east side of the new Santa Clara Station northbound platform, and would connect to the existing tracks south of I-880. Like Alternative 1, Alternative 2 would shift the freight tracks at the Lenzen Wye; however, the curves would be different. South of San Jose Diridon Station, Alternatives 1 and 2 would be the same.

Land Use and Community Modifications

The HSR facilities in this subsection would be constructed predominantly in the existing Caltrain right-of-way. Like Alternative 1, the HSR alignment would diverge from the Caltrain right-of-way just south of the San Jose Diridon Station along a southeast alignment over the I-280/SR 87 interchange before returning to the Caltrain right-of-way just north of the Tamien Caltrain Station. This alternative would require modifications of some intersections and acquisition of additional TCEs and permanent acquisition of right-of-way in some areas along the alignment.

Monterey Corridor Subsection

Alignment and Ancillary Features

CP Lick

Control Point or CP Lick is the location where Caltrain ownership of the rail right-of-way transitions to UPRR. It is located south of the Tamien Caltrain station.

The Monterey Corridor Subsection is approximately 9 miles long and entirely within the San Jose city limits. Between West Alma Avenue and the northern base of Communications Hill, Alternative 2 would be the same as Alternatives 1 and 3. However, Alternative 2 would begin the viaduct transition to the Monterey Road/UPRR corridor approximately 400 feet north of the transition under Alternatives 1 and 3 but would be primarily at grade or on embankment upon entering the road/rail corridor. Alterations of existing railroad track and systems between West Alma Avenue and CP Lick (near the east base of Communications Hill) would be the same as under Alternatives 1 and 3 except for a new, continuous intrusion barrier between the existing UPRR tracks and HSR tracks.

From West Alma Avenue, the HSR alignment would descend from a viaduct 54 feet above grade to embankment north of Almaden Road. The alignment would continue primarily on embankment on the west side of the Caltrain/UPRR tracks, crossing over Almaden Road on a short aerial structure, then proceeding at grade under West Almaden Expressway and Curtner Avenue. South of Curtner Avenue, the alignment would continue south at grade along the west side of the Caltrain/UPRR tracks around the northern base of Communications Hill, ascending to aerial structure before crossing over and entering the Monterey Road/UPRR corridor just south of Hillsdale Avenue. On the approach to Monterey Road, the aerial structure would cross over the UPRR tracks and the Caltrain Capitol Station while curving southeast to return to grade within the road/rail corridor northwest of the Capitol Expressway. Monterey Road would be realigned to the east, while HSR would run along the east side of UPRR. South of Fehren Drive, Monterey Road would be reduced from six to four lanes. Continuing south, the alignment would descend into a trench beneath a widened Capitol Expressway bridge before ascending to grade at Skyway Drive. Under Skyway Drive Variant A, Monterey Road would retain its current at-grade configuration, and a new connector ramp at the north corner of the intersection of Skyway Drive and Monterey Road would connect Monterey Road to the depressed Skyway Drive underpass. San Jose Fire Station #18 would have access along the connector ramp. Skyway Drive Variant B would depress Monterey Road to connect to the Skyway Drive underpass. Under this variant, access to the mobile home park north of the intersection of Skyway Drive and Monterey Road

would be provided by an access road across the northern portion of the San Jose South Service Yard property. Variant B would not provide access to the fire station.

Continuing south, the HSR alignment would be at grade or on embankment between Monterey Road and UPRR for the remainder of the subsection. Branham Lane and Roeder Road/Chynoweth Avenue would be lowered to be separated from the HSR and existing railroad crossings. Because of the new grade difference between Branham Lane and Roeder Road/Chynoweth, access to Rice Way and four driveways from Monterey Road would be closed. A new Branham Lane pedestrian bridge would span the combined railroad and Monterey Road corridor. The westbound Blossom Hill Road ramp at Monterey Road would be shifted to the east side of Monterey Road. A new pedestrian bridge would be built to maintain connectivity between Ford Road and the Caltrain Blossom Hill Station. The alignment would continue south at grade under SR 85/West Valley Freeway, with modifications to the existing highway bridge to allow HSR to pass underneath. The alignment would then cross under Bernal Road before transitioning to the Morgan Hill and Gilroy Subsection at Bernal Way.

Like the other alternatives, the design assumes a reduction from six to four travel lanes on Monterey Road, beginning north of Capitol Expressway and continuing south to Blossom Hill Road; south of Blossom Hill Road the existing roadway is already four travel lanes. Under Alternative 2, one left turn lane would be removed south of Senter Street and one left turn lane would be removed south of Roeder where Monterey Road would be depressed and grade-separated from adjacent properties. Existing mid-block left-turn lanes would be closed because of substandard stopping sight distance. Alternative 2 (and Alternative 4) differs from Alternatives 1 and 3 by shifting all Monterey Road travel lanes and median east of their current locations.

Traction Power Facilities

In the Monterey Corridor Subsection, traction power stations would be located in the same area for Alternatives 1, 2, and 3. Traction power paralleling stations would be constructed at the following locations:

- Either the north side of the alignment near Curtner Avenue or the south side of the alignment at Communications Hill (same as Alternative 1)
- Either the south side of SR 85 or between Bernal Road and the Bernal Road ramp onto Monterey Road

Train Control and Communication Facilities

Train control facilities and communication facilities under Alternative 2 would be as described for Alternative 1.

Wildlife Crossings

There would be no wildlife crossings in this subsection.

Stations

No HSR stations are proposed for this subsection.

Maintenance Facilities

No maintenance facilities are proposed for this subsection.

State Highway or Local Roadway Modifications

Appendix 2-A details shows local road modifications that would be necessary in the Monterey Corridor subsection.

Freight or Passenger Rail Modifications

Construction in this subsection would require temporary use of UPRR right-of-way for construction staging. Alternative 2 would be the same as Alternative 1 between West Alma Avenue and Communications Hill, and also at the Capitol Station. Permanent modifications would occur at the following locations:

- **Daylight Way**—Sliver of UPRR right-of-way required
- **South of Daylight Way**—This area is needed to transition from HSR running on the west of the UPRR alignment to curve over UPRR right-of-way and transition to running along Monterey Road on the east side of UPRR alignment
- **Fehren Drive to Capitol Expressway**—HSR alignment would be constructed on straddle bents to pass over UPRR
- **New rail bridge**—New bridge over new grade separations (Skyway Drive, Branham Lane, Chynoweth Avenue)
- **New pedestrian overcrossing**—New overcrossing at Blossom Hill Station

Land Use and Community Modifications

This alternative would require acquisition of residential, commercial, and industrial properties in this subsection to obtain adequate right-of-way for construction and operations.

Morgan Hill and Gilroy Subsection

Alignment and Ancillary Features

The Morgan Hill and Gilroy Subsection under Alternative 2 would be approximately 31 miles long, continuing south from the Monterey Corridor Subsection. From Bernal Way in South San Jose, the alignment would extend through Morgan Hill and San Martin to the Downtown Gilroy Station, then curve generally east across the Pajaro River floodplain and through a portion of northern San Benito County before entering Tunnel 1 at the base of the Diablo Range. The alignment would exit the tunnel at Casa de Fruta Parkway/SR 152 in unincorporated eastern Santa Clara County, and then transition to the Pacheco Pass Subsection (Figure 2-1).

From the southern limit of the Monterey Corridor Subsection, Alternative 2 would be at grade on retained fill between the UPRR right-of-way and Monterey Road in South San Jose. Because of the guideway's proximity to UPRR, a 3-foot-thick continuous intrusion barrier would be constructed between the HSR and UPRR tracks. In contrast to the other alternatives, Alternative 2 would require construction of new roadway grade separations to maintain east-west connectivity across Monterey Road. Before turning south near Kittery Court, the two UPRR tracks would be realigned to the west to accommodate the alignment curvature required for HSR operations before returning to the existing alignment adjacent to the south side of the Calpine Metcalf Energy Center. The existing Fisher Creek culvert would be improved with a new culvert installed beneath the new HSR alignment, realigned Monterey Road, and UPRR. The creek crossing would be improved to provide a suitable wildlife crossing. The Blanchard Road grade crossing would be closed.

As the UPRR and Monterey Road rights-of-way converge to the south approaching Bailey Avenue, the four-lane Monterey Road would be realigned eastward to accommodate the HSR alignment at grade between the railroad and roadway. The existing Bailey Avenue bridge would remain in place and HSR would cross beneath the road. The alignment would continue south, ascending onto embankment, crossing beneath a new Palm Avenue bridge and a new Live Oak Avenue bridge (which would also cross over UPRR, eliminating both existing at-grade crossings). Tilton Avenue would become a cul-de-sac. Madrone Parkway would be lowered to allow HSR and UPRR to cross over the roadway. At Cochrane Road, the realigned Monterey Road would converge with the existing roadway alignment.

South along the UPRR alignment through Morgan Hill, a new culvert would be placed in the HSR embankment for Fisher Creek. The alignment would then cross over Monterey Road on a clear-span bridge. Continuing south on embankment along the east side of UPRR, the HSR and UPRR alignments would cross over Main, East/West Dunne, San Pedro, and Tennant Avenues on short bridges over the roadways, which would be lowered 17 to 30 feet below grade to maintain east-west connections. A new pedestrian underpass would be provided to maintain access from east of the HSR corridor to the Morgan Hill Caltrain Station. Railroad Avenue would be closed between San Pedro Avenue and Barrett Avenue and relocated eastward between Barrett Avenue and Maple Avenue to accommodate the HSR alignment adjacent to UPRR. The existing bridge at Butterfield Boulevard would be extended to cross over the realigned Railroad Avenue and at-grade HSR alignment. The Butterfield canal would be relocated to the east to accommodate the HSR alignment adjacent to UPRR.

Continuing south, the alignment would ascend onto embankment, and West Little Llagas Creek would flow through a new culvert. The existing East Middle Avenue would become cul-de-sacs on both sides of the alignment. A new alignment of East Middle Avenue would be built to the south, where it would cross over the HSR tracks and Monterey Road on a bridge. Monterey Road and UPRR would be realigned westward between East Middle Avenue and Roosevelt Avenue to accommodate the southward alignment curvature required for HSR operations. The realigned roadway, UPRR, and the new HSR alignment would cross Llagas Creek on new clear-span bridges. South of Llagas Creek, Monterey Road would return to the existing alignment near Roosevelt Avenue.

San Martin Avenue would be realigned between Murphy and Harding Avenues to connect to Oak Street at Llagas Avenue (north of the HSR alignment) in San Martin. HSR would cross over San Martin Avenue and Oak Street, which would be below grade. A pedestrian path under the HSR embankment would be provided south to San Martin Avenue. Depot Street, UPRR, and Monterey Road, which parallel the HSR tracks at Oak Street, would cross the newly depressed San Martin (formerly Oak) Street on bridges supported by retained fill. HSR would continue south at grade adjacent to the east side of UPRR. Church Avenue would be raised onto a bridge over both HSR and UPRR. Fitzgerald and Masten Avenues would be realigned to the south and would be depressed beneath Monterey Road, UPRR, and HSR. Similarly, Rucker Avenue and Buena Vista Avenue would be depressed beneath Monterey Road, UPRR, and HSR. Both Cohansey Avenue and Las Animas Avenue would remain at grade, with bridges for HSR and UPRR to cross over the existing streets.

Continuing south into Gilroy, the alignment would shift east for the approach to the Downtown Gilroy Station. The existing culvert for the West Branch of Llagas Creek would be extended to the east to accommodate the rail alignment shift. HSR and UPRR would be on embankment (approximately 15–25 feet high) and cross over Leavesley Road, Casey Street, IOOF Avenue, Lewis Street, East 6th Street, and the realigned East 7th Street/Old Gilroy on bridges before arriving at the Downtown Gilroy Station embankment (approximately 16 feet high). Each of these streets would be lowered approximately 20 feet beneath existing grade, and a pedestrian underpass would replace Martin Street across the rail alignment. Miller Slough would be realigned eastward in a new culvert beneath the railroad alignment. HSR and UPRR would continue on embankment and cross over East 9th Street and East 10th Street.

The HSR alignment would continue on embankment south from the Downtown Gilroy Station to the Princevale Channel, then descend into a trench under Luchessa Avenue and US 101 where existing bridges would be demolished and reconstructed to accommodate the freeway undercrossing and two UPRR spur tracks. Just south of the US 101 overcrossing, a freight connection would be made from UPRR on the south side of HSR, crossing over the HSR trench to connect to the Gilroy MOWF on the north side of HSR. Two UPRR spur tracks would be realigned to connect to the MOWF freight track north of HSR.

The remainder of this subsection—to Casa de Fruta—would be the same as under Alternative 1. The Tunnel 1 design variant would be the same as described in Alternative 1.

Tunnel Design Variant

The characteristics of the TDV in the Morgan Hill and Gilroy Subsection under Alternative 2 would be the same as described in the Morgan Hill and Gilroy Subsection under Alternative 1.

Traction Power Facilities

As under Alternative 1, one new TPSS, Site 4—Gilroy, would be constructed at one of two alternate sites on the north side of the alignment: east or west of Bloomfield Avenue. At this location, one new utility switching station would be co-located with the TPSS. Communication facilities (i.e., redundant fiber optic lines) would also be required to support the electrical interconnection of the TPSS to a new utility switching station, to existing PG&E facilities, or both—typically within tie-line/utility corridors. Site 4—Gilroy would connect to the Llagas PG&E substation via existing and proposed transmission or distribution lines along SR 152, Frazier Lake Road, and Bloomfield Avenue. Fiber optic and high-voltage lines would be reconductored overhead on existing towers where available. Where no overhead connections exist, both fiber optic and high-voltage lines would be undergrounded within or adjacent to the public right-of-way.

A traction power switching station would be constructed east of the HSR alignment at a location north of Paquita Espana Court or north of Palm Avenue.

Two traction power paralleling stations would be constructed at the following locations:

- Either the east side of the alignment between East Dunne and San Pedro Avenues or south of San Pedro Avenue
- East of the alignment, either north or south of a new Masten Avenue/Fitzgerald Avenue in-trench alignment

South of US 101, Alternative 2 would have the same two switching stations as Alternative 1:

- Either south of the alignment and west of Lovers Lane or north of the alignment and west of Lovers Lane
- In the vicinity of the Tunnel 1 east portal, either at the portal or east of SR 152 in the southern area of Casa de Fruta.

PG&E would reinforce the electric power distribution network to meet HSR traction and distribution power requirements by reconductoring the approximately 9.8-mile Metcalf to Morgan Hill and 10.6-mile Morgan Hill to Llagas 115-kV power lines. These PG&E transmission network upgrades described under Alternative 1 would also be necessary under Alternative 2.

Train Control and Communication Facilities

A total of 20 ATC sites would be constructed in the Morgan Hill and Gilroy Subsection for this alternative, three of which would be the same as those under Alternative 1:

- One site east of Monterey Road north of Palm Avenue (two site options)
- One site north of East Middle Avenue (two site options)
- One site between Las Animas Avenue and Leavesley Road
- One site south of Leavesley Road
- One site south of Lewis Street
- One site north of 6th Street in Gilroy
- Two sites south of 6th Street in Gilroy
- Two sites between 9th and 10th Streets in Gilroy
- One site south of Banes Lane
- Five sites north of Carnadero Avenue (same as Alternative 1)
- Three sites east of the Pajaro River (same as Alternative 1)
- One site near Lake Road (two site options—same as Alternative 1)

A total of six standalone communication radio sites would be constructed in this subsection at the following locations, one of which would be the same as under Alternative 1:

- Between Forsum Road and Blanchard Road (two site options)
- Near Bailey Avenue (two site options)
- Near Kirby Avenue (two site options)
- West of the intersection of Cochrane Road and Monterey Road (two site options)
- Near South Street (two site options)
- East of the Pajaro River south of Gilroy (same as Alternative 1)

Wildlife Crossings

Three adjacent box culverts would be installed to provide wildlife with a connection between Tulare Hill and Coyote Creek south of Metcalf Road. The box culverts under Monterey Road and UPRR would be replaced with larger box culverts at Fisher Creek. HSR would also be on a box culvert over Fisher Creek. These three box culverts would have larger openings than existing culverts to improve wildlife movement. There would be seven additional crossings at Emado Avenue, Laguna Avenue, Richmond Avenue, Fox Lane, Paquita Espana Court, south of Palm Avenue, and south of Live Oak Avenue.

Stations

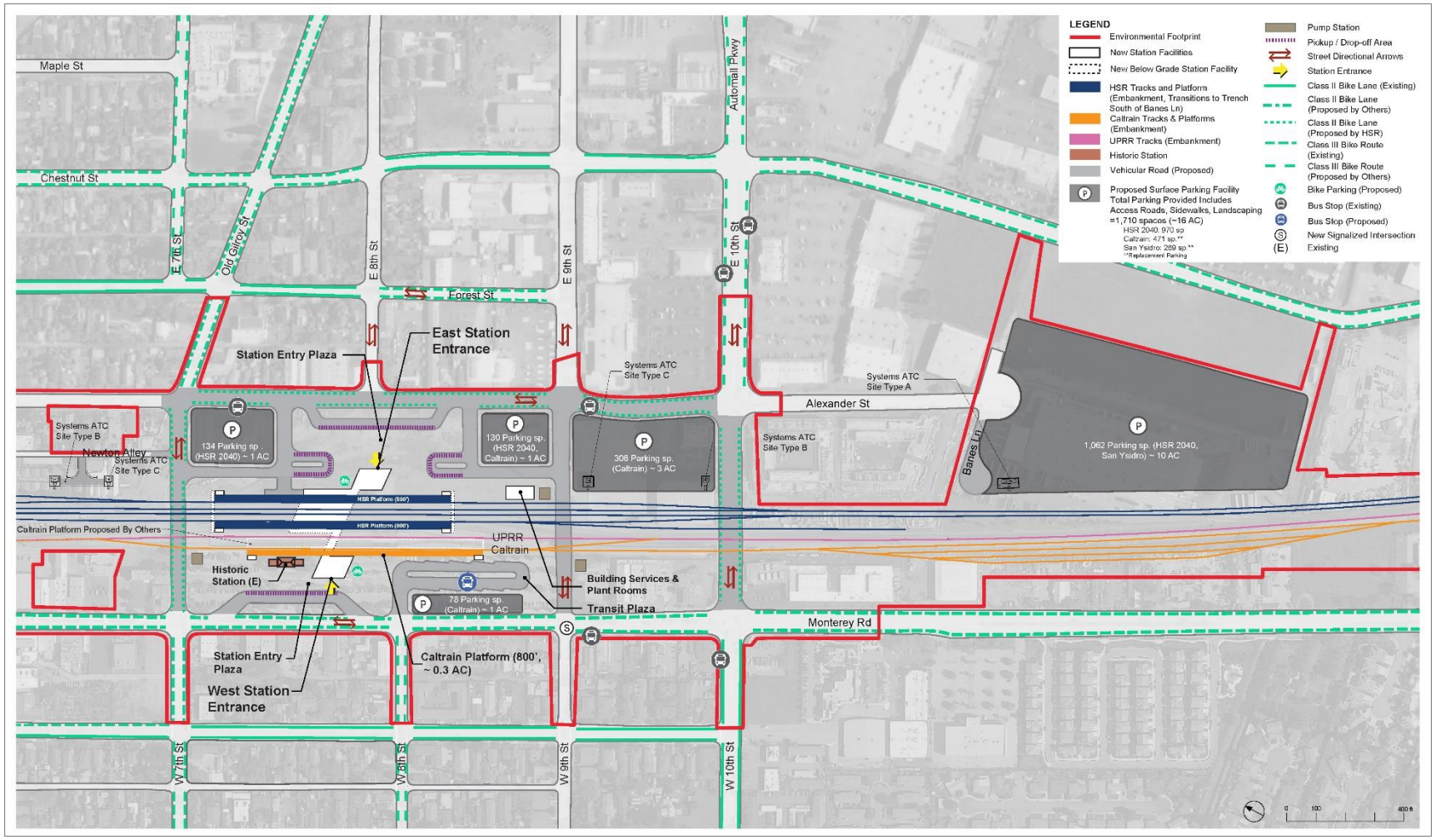
The Downtown Gilroy Station under Alternative 2 is estimated to have approximately 6,210 boardings in 2040. The station layout and configuration would be similar to those described for Alternative 1, except that UPRR and Caltrain would be elevated to the same height as HSR on the embankment. The station approach would be on embankment approximately 15 feet to top of rail, with dedicated HSR tracks to the east of UPRR between relocated Old Gilroy Street/7th Street and 9th Street. The 800-foot platforms would be on the Caltrain side of the tracks. A new HSR station would be constructed south of the existing Caltrain station. The new HSR station building would have both east and west side entrances: the main entrance for passengers arriving by auto or bicycle would be on the east side, while the main entrance for passengers arriving on foot or by transit would be on the west side. The HSR station building would encompass 64,913 square feet with a 4,400-square-foot substation and systems building. The concourse would be below raised UPRR and Caltrain tracks.

As under Alternative 1, the existing 471 Caltrain parking spaces on the west side of the station would be replaced 1:1 by either reconfiguring parking on the west side of the station or relocating it to the east side of the station. The existing 269 San Ysidro housing development parking spaces would be replaced 1:1 with new surface parking along Automall Parkway with access from the south end of Alexander Street. HSR would provide an additional 970 spaces in 2040, for a total of 1,710 parking spaces in 2040 (including existing demand). The station site plan provides 970 new parking spaces in five areas. One site would be west of the station along Monterey Road at 9th Street. The other four would be on the east side of the station along Alexander Street at Old Gilroy Street, 9th Street, 10th Street, and Banes Lane. A multimodal access plan would be developed prior to design and construction of the station. The plan would be developed in coordination with local agencies and would include a parking strategy that would confirm the location, amount, and phasing of parking.

A total of eight bus bays would be provided. Street improvements would include realignment of Old Gilroy Street at East 7th Street; existing grade crossings would remain unchanged. A 4,000-square-foot bicycle facility would be built. Class II bike lanes would be provided on 7th, Alexander, and 10th Streets. Figure 2-60 and Figure 2-61 illustrate the conceptual on-embankment downtown Gilroy station.

Maintenance Facilities

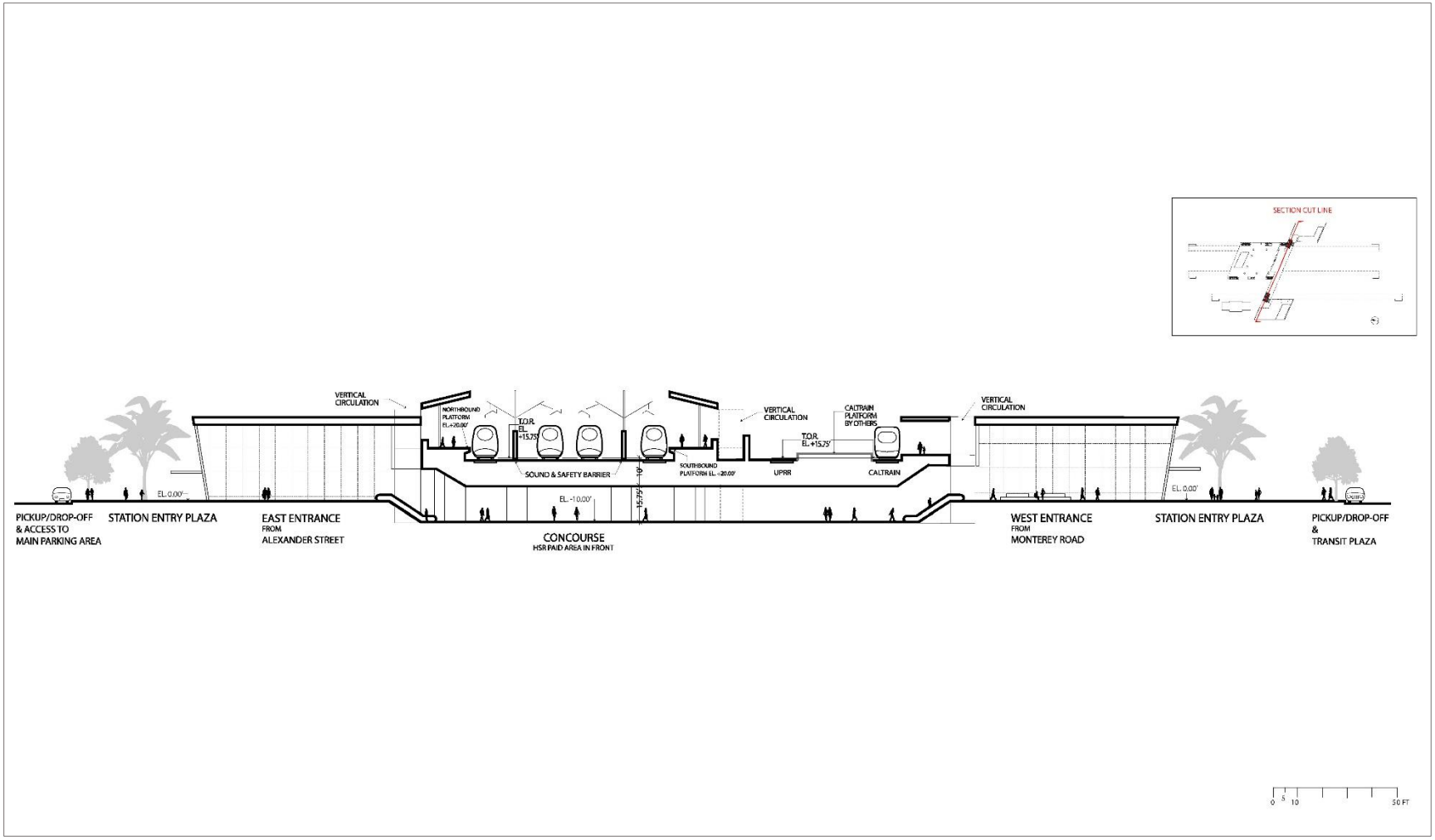
The South Gilroy MOWF under Alternative 2 would be constructed along the HSR alignment near Carnadero Avenue as described for Alternative 1 and illustrated on Figure 2-42. The freight connection would be provided as described above.



Source: Authority 2019a

JUNE 2019

Figure 2-60 Conceptual Downtown Gilroy Embankment Station Plan (Alternative 2)



Source: Authority 2019a

JUNE 2019

Figure 2-61 Cross Section of Downtown Gilroy Embankment Station (Alternative 2)

State Highway or Local Roadway Modifications

Appendix 2-A details local road modifications that would be necessary in the Morgan Hill and Gilroy Subsection.

Freight or Passenger Rail Modifications

Construction in this subsection would require temporary use of areas of UPRR right-of-way for construction staging. Permanent modifications would occur at the following locations:

- For new road or rail bridges at all new grade separations
- Felice Court to Blanchard Road to allow for shifting UPRR tracks west
- South of Blanchard Road—a sliver of UPRR right-of-way required for embankment construction
- North of Campoli Drive
- East Third Street to south of Diana Avenue—right-of-way required
- Pollard Avenue to San Martin Avenue—permanent right-of-way acquisition for relocation of UPRR
- North Street to South Street—right-of-way required for HSR construction
- South of grade-separated Fitzgerald Avenue/Masten Avenue—a sliver of right-of-way required
- North of Denio Avenue to Lewis Street for shifting of UPRR track east
- East 6th Street to Luchessa—right-of-way required for construction of the Downtown Gilroy Station and approach from the north
- South of US 101 to allow for two relocated spur tracks, a shifted siding track with new UPRR right-of-way, and a new freight connection to the MOWF

Land Use and Community Modifications

Alternative 2 would require acquisition of residential, commercial, and industrial properties in this subsection to obtain adequate right-of-way for construction and operations.

Pacheco Pass Subsection

The characteristics of the Pacheco Pass Subsection under Alternative 2 would be as described for Alternative 1. The Tunnel 2 design variant would be the same as described in Alternative 1.

San Joaquin Valley Subsection

The characteristics of the San Joaquin Valley Subsection under Alternative 2 would be the same as those described for Alternative 1.

2.6.2.6 Alternative 3

Rationale

Alternative 3 was designed to minimize the project footprint through the use of viaduct and by going around downtown Morgan Hill, much like Alternative 1. Alternative 3 would bypass downtown Gilroy to an East Gilroy Station, further minimizing interface with the UPRR corridor in comparison to Alternative 1. Like Alternative 2, Alternative 3 would use the viaduct to Scott Boulevard design option, requiring less disruption of UPRR track than the shorter viaduct to I-880 option. Alternative 3 would incorporate the same alignment and profile as Alternative 1 in the Monterey Corridor, Pacheco Pass, and San Joaquin Valley Subsections, and the same alignment and profile as Alternative 2 in the San Jose Diridon Station Approach Subsection. The MOWS would be the same under all alternatives.

Alternative 3 would operate in a dedicated viaduct from Scott Boulevard through the San Jose Diridon Station Approach Subsection. The alternative would continue predominantly on viaduct

through the Monterey Corridor and Morgan Hill and Gilroy Subsections on an alignment around downtown Morgan Hill to an embankment approach to the East Gilroy Station. Alternative 3 would include an East Gilroy MOWF and would continue predominantly on viaduct and embankment across the Soap Lake floodplain before entering Tunnel 1 west of Casa De Fruta. The alignment and guideway in the Pacheco Pass and San Joaquin Subsections would be the same under all four alternatives.

Overall, this alternative would comprise 43.2 miles on viaduct, 1.8 miles at grade, 24.9 miles on embankment, 2.4 miles in trench, and two tunnels totaling 15.0 miles. Figure 2-62 illustrates the alignment and track profile of Alternative 3.

San Jose Diridon Station Approach Subsection

Alignment and Ancillary Features

Under Alternative 3, the alignment and characteristics of this subsection would be as described for Alternative 2.

Stations

The HSR San Jose Diridon Station would be built as described for Alternatives 1 and 2.

Traction Power Facilities

Traction power facilities of Alternative 3 would be as described for Alternative 2.

Train Control and Communication Facilities

Train control and communication facilities under Alternative 3 would be the same as described for Alternative 2. No standalone communication radio towers would be constructed in this subsection under Alternative 3.

Maintenance Facilities

No maintenance facilities are proposed for this subsection.

State Highway or Local Roadway Modifications

State highway or local roadway modifications would be as described for Alternative 2.

Freight or Passenger Rail Modifications

Freight or passenger rail modifications would be as described for Alternative 2.

Land Use and Community Modifications

The alignment and features in this subsection would be as described for Alternative 2.

Monterey Corridor Subsection

Alignment and Ancillary Features

The alignment and features in the Monterey Corridor Subsection would be as described for Alternative 1.

Stations

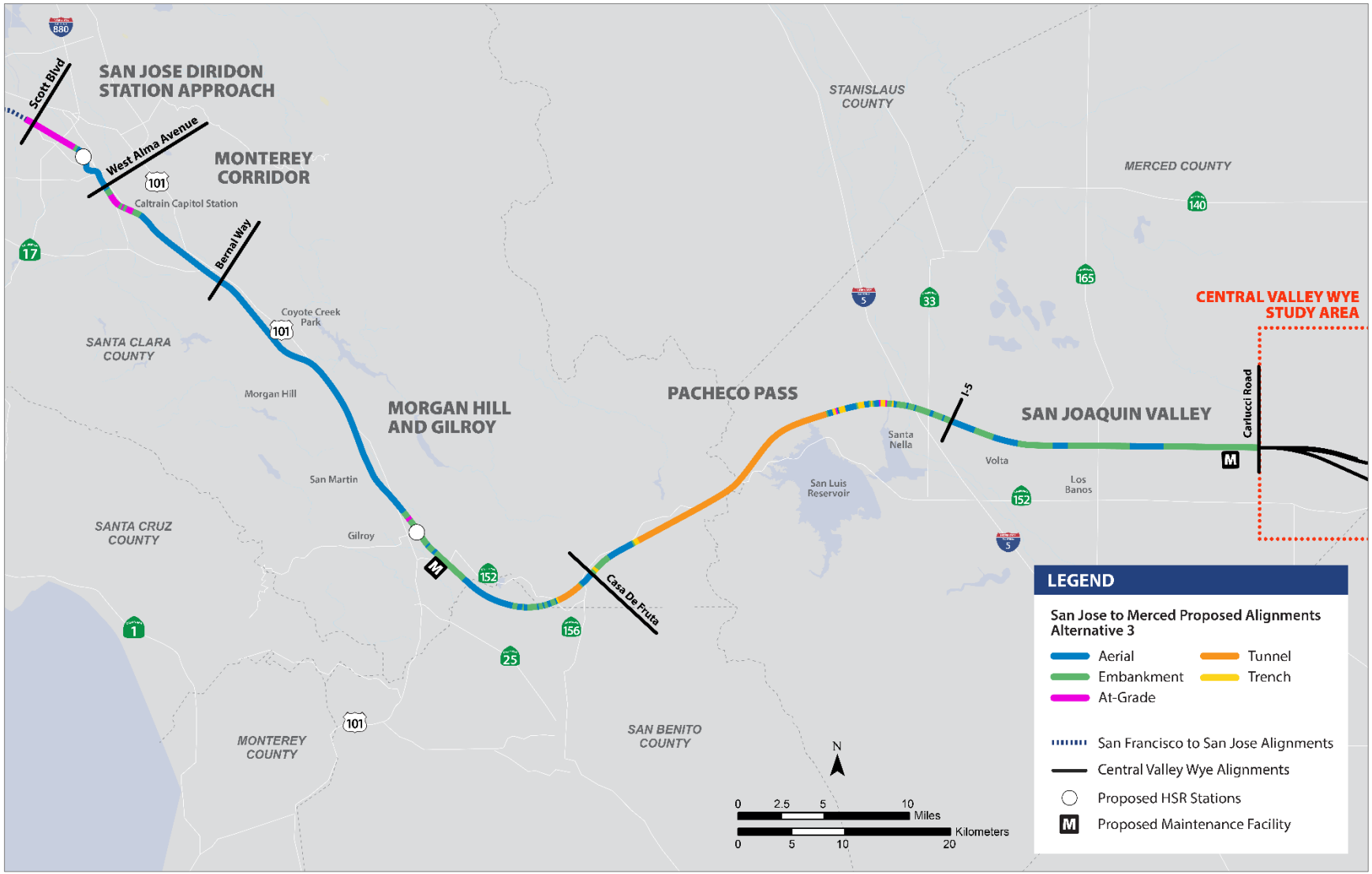
No stations are proposed in this subsection.

Traction Power Facilities

Traction power facilities under Alternative 3 would be as described for Alternative 1.

Train Control and Communication Facilities

Train control and communications facilities under Alternative 3 would be as described for Alternative 1.



Source: Authority 2019a

JUNE 2019

Figure 2-62 Alternative 3 Proposed Alignment

Maintenance Facilities

No maintenance facilities are proposed in this subsection.

State Highway or Local Roadway Modifications

State highway or local roadway modifications would be as described for Alternative 1.

Freight or Passenger Rail Modifications

Freight rail modifications would be as described for Alternative 1.

Land Use and Community Modifications

Alternative 3 would require acquisition of residential, commercial, and industrial properties in this subsection to obtain adequate right-of-way for construction and operations.

Morgan Hill and Gilroy Subsection

Alignment and Ancillary Features

The Morgan Hill and Gilroy Subsection under Alternative 3 would be approximately 30 miles long, continuing south from the Monterey Corridor Subsection. From Bernal Way in South San Jose, the alignment through Morgan Hill and San Martin would be the same as described for Alternative 1. The Alternative 3 alignment would diverge from the Alternative 1 alignment by turning east north of Gilroy to arrive at the East Gilroy Station and an MOWF near SR 152. South of the MOWF, the alignment would curve generally east across the Pajaro River floodplain and through a portion of northern San Benito County before entering Tunnel 1 at the base of the Diablo Range. The Morgan Hill and Gilroy Subsection would end in the Pacheco Pass at Casa de Fruta Parkway/SR 152 (Figure 2-1), where the Alternative 3 alignment would converge with those of Alternatives 1, 2, and 4.

South of the Monterey Corridor Subsection, Alternative 3 would diverge east from Alternative 1 north of Gilroy, near the intersection of Monterey Road and Church Avenue. Beginning at Church Avenue, a new freight track would diverge off the UPRR mainline to provide a freight connection to the MOWF. The freight track would continue parallel to the HSR alignment on the west side until the MOWF. The alignment would cross over Church Avenue, Lena Avenue, Masten Avenue, and US 101 at Rucker Avenue on viaduct approximately 60 feet above grade. The aerial alignment would also cross over Denio Avenue and Buena Vista Avenue on viaduct before descending onto embankment. Cohansey Avenue would be closed. On the north end of the East Gilroy Station site, the alignment would cross beneath Las Animas Avenue; on the south end of the station site, Leavesley Road would be raised on bridges over the HSR embankment. At the south end of the East Gilroy Station site, the Llagas Creek overbank flow would be directed across the HSR alignment through two culvert crossings. Farther southeast, the alignment would cross over Gilman Avenue on viaduct. The alignment would cross Llagas Creek on a low viaduct, and Holsclaw Road would be closed to vehicular traffic. Levee Road would be realigned north of Llagas Creek. Continuing south, the alignment would ascend to approximately 25 feet above grade on embankment approaching the MOWF site. SR 152 would be grade-separated and realigned, crossing over the MOWF on a bridge. Both Frazier Lake Road and Holsclaw Road would connect to the grade-separated SR 152. The MOWF, on the south side of the alignment, would have the same features as the MOWF for Alternatives 1 and 2 and would similarly be on embankment. Additional flood detention basins would be installed around the eastern edge of the MOWF to provide sufficient flood capacity in the Soap Lake floodplain. Jones Creek would be realigned around the eastern boundary of the MOWF, crossing beneath the HSR viaduct over Bloomfield Avenue. Continuing on a 40-foot-high embankment and then on viaduct, the alignment would cross the Pajaro River, Millers Canal, Lake Road, Pacheco Creek, Lovers Lane, San Felipe Road, and SR 152 before entering the west portal of Tunnel 1. Tequesquita Slough would be partially filled by the HSR embankment, which would include cross-culverts, 3.1 acres of adjacent floodwater detention basins, and extended viaduct over Pacheco Creek to maintain floodplain capacity and function.

The Alternative 3 alignment would converge a short distance west of Tunnel 1 with the alignments of Alternatives 1, 2, and 4. The Tunnel 1 design variant would be the same as described in Alternative 1.

Tunnel Design Variant

The characteristics of the TDV in the Morgan Hill and Gilroy Subsection under Alternative 3 would be the same as described in the Morgan Hill and Gilroy Subsection under Alternative 1.

Traction Power Facilities

Under Alternative 3, one new TPSS, Site 4—Gilroy, would be constructed at one of two sites: north of the alignment either east or west of the former SR 152. Communication facilities (i.e., redundant fiber optic lines) would also be required to support the electrical interconnection of the TPSS to a new PG&E switching station, to existing PG&E facilities, or both—typically within tie-line/utility corridors.

As under Alternative 1, a traction power switching station would be constructed at one of two locations north of Palm Avenue and east of the alignment.

Four traction power paralleling stations would be constructed at the following locations:

- South of the alignment, either south of Diana Avenue or at the intersection of San Pedro Avenue and Walnut Grove Drive (same as Alternative 1)
- Either at the northwest or southeast corner of the HSR crossing of Masten Avenue
- South of Gilroy at one of three site options: on Lake Road north of the alignment, on Lake Road south of the alignment, or at Lovers Lane south of the alignment
- Near the Tunnel 1 east portal, either at the portal or east of SR 152 in the southern area of Casa de Fruta

The PG&E transmission network upgrades from Metcalf to Morgan Hill and from Morgan Hill to Llagas described for Alternative 1 would also be necessary under Alternative 3. In addition to a new utility switching station co-located with the TPSS, a tie-line route and power distribution to the Tunnel 1 portal under this alternative would be the same, albeit with shorter electrical line routes, as those described for Alternative 1. A distribution power line for the Tunnel 1 portals would be constructed on the south side of the alignment northeast of the intersection of Walnut Lane and SR 152, crossing over and connecting with the TPSS from the north. One power drop site would be provided at the east and west portals (two options for each portal location).

Train Control and Communication Facilities

A total of 21 ATC sites would be constructed in the Morgan Hill and Gilroy Subsection for this alternative:

- One site east of Monterey Road near Palm Avenue (two site options)
- One site East Middle Avenue (two site options)
- Two sites near Cohansey Way
- Four sites between Las Animas Avenue and Leavesley Road
- Three sites south of Leavesley Road
- Four sites north of SR 152, east of Gilroy
- Two sites within the MOWF
- Three sites north of Bloomfield Avenue
- One site near Lake Road (two site options)

A total of six standalone communication radio sites would be constructed within this subsection at the following locations (five locations are the same as those for Alternative 1):

- At Forsum Road or at Blanchard Road (two site options)
- Near Bailey Avenue (two site options)
- Between Barnhart Avenue and Kirby Avenue (two site options)
- South of Cochrane Road along US 101 (two site options)
- North of Cox Avenue and south of West San Martin Avenue (two site options)
- At Bloomfield Avenue

Wildlife Crossings

Wildlife crossings would be provided between Bernal Way and San Martin as described for Alternative 1, with crossings at Tulare Hill, Fisher Creek, and Llagas Creek. Although Alternative 3 would include more embankment than Alternative 1, it would be similar to Alternative 1 by continuing primarily on viaduct through the Soap Lake area to allow for wildlife movement.

Stations

The HSR East Gilroy Station is estimated to have approximately 6,210 boardings in 2040. The station approach would be on embankment approximately 17 feet to top of rail north of Leavesley Road (Figure 2-63 and Figure 2-64). The platforms would be 800 feet long. The station buildings would be constructed on both the east and west sides of the tracks with a connecting concourse under the tracks. The MOWF freight access track would continue through the station on the west side of the west station platform. Access for passengers arriving by auto would be available from either the east or west entrance, while the main entrance would be on the west side providing access for passengers arriving by transit or bicycle.

The HSR station buildings would encompass 58,611 square feet with a 4,400-square-foot substation and systems building. The concourse would be below the tracks and embankment. Approximately 1,520 on-site parking spaces would be provided to meet the projected demand for 1,520 spaces in 2040. Spaces would be on the east and west sides of the building. The west side station parking would be accessed from Leavesley Road and a new station access road east of the outlet mall. The east side station parking would be accessed from Marcella Avenue. A multimodal access plan would be developed prior to design and construction of the station. The plan would be developed in coordination with local agencies and would include a parking strategy that would confirm the location, amount, and phasing of parking.

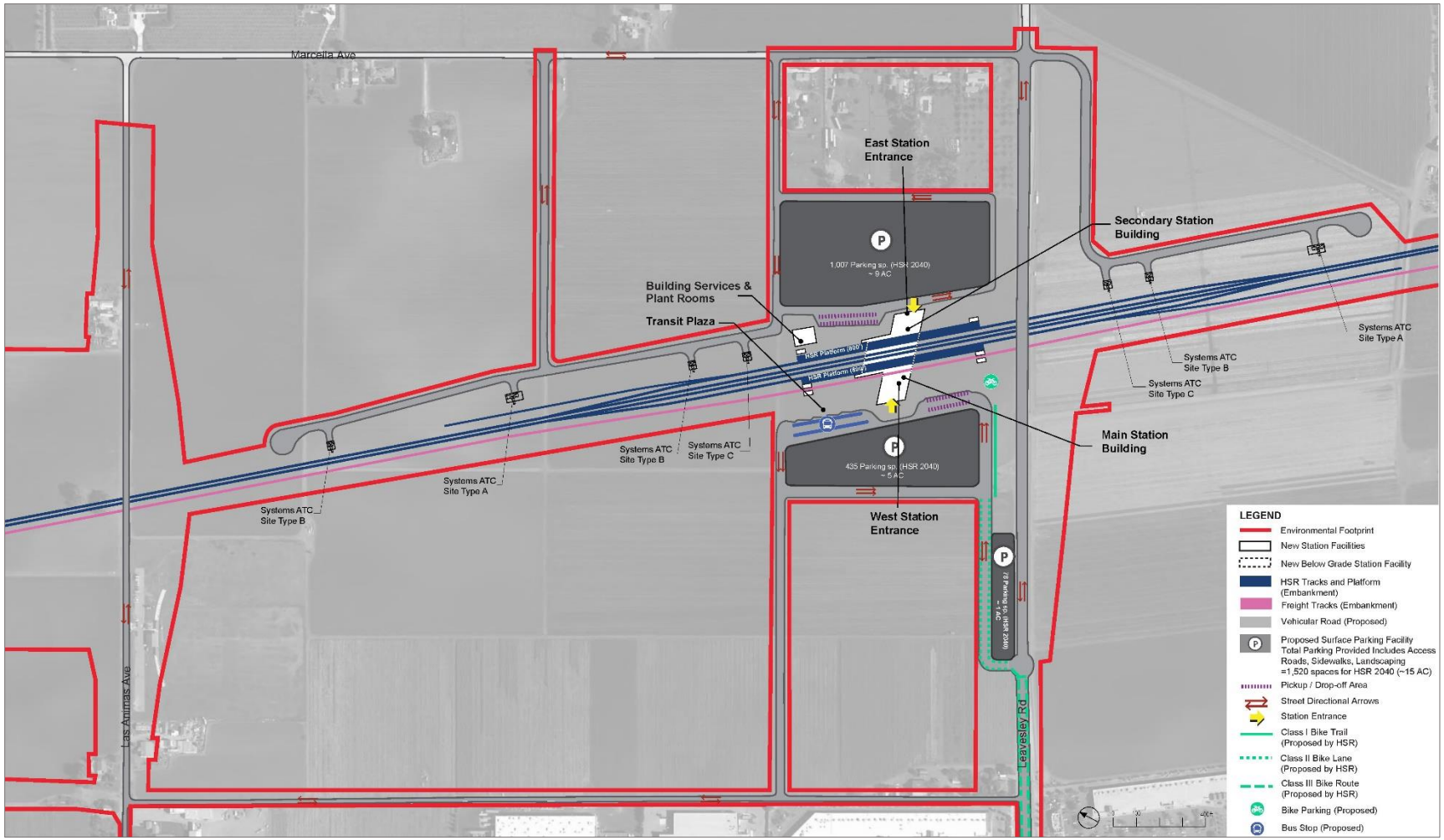
Seven bus bays would be provided on site on the west side of the station. A 4,000-square-foot bicycle parking facility would be built; a new Class III bike route would be provided from the outlet mall to the site entrance and Class II lanes from the station entrance to the parking. A Class I bidirectional off-street path would be provided adjacent to parking, connecting to the bike station. This would be a new station without any other rail operators in the station area.

Maintenance Facilities

Alternative 3 would include the East Gilroy MOWF west of the HSR mainline, south of the community of Old Gilroy (Figure 2-44). The MOWF would encompass approximately 75 acres and extend along the west side of the HSR alignment from the intersection of SR 152 and Frazier Lake Road south to Jones Creek. The site is near Holsclaw Road, a potentially eligible historic landscape, and is within the Soap Lake floodplain. The freight connection would be provided as described in the discussion of the alignment and ancillary facilities.

State Highway or Local Roadway Modifications

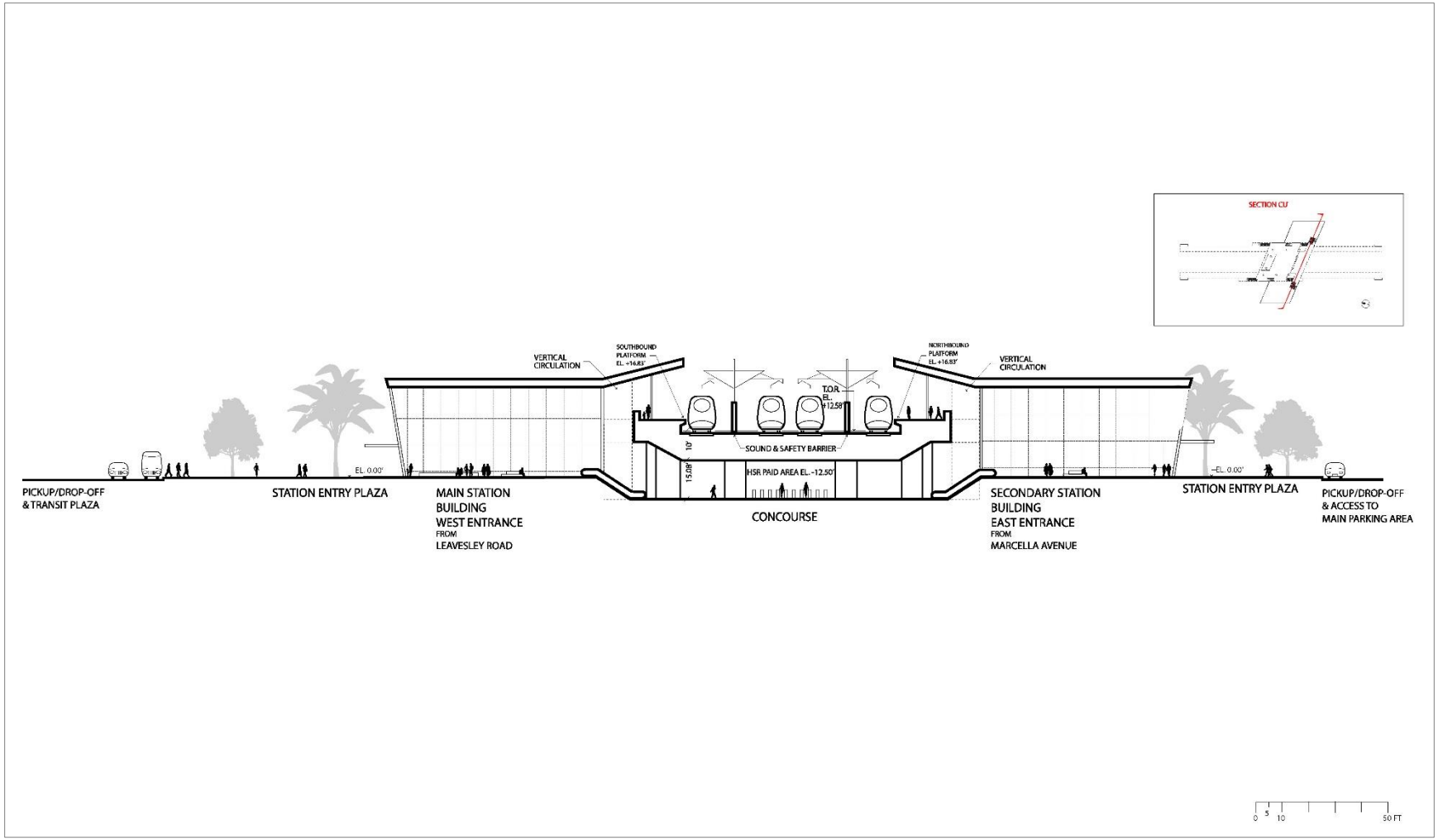
Appendix 2-A details local road modifications that would be necessary in the Morgan Hill and Gilroy Subsection.


Marcella Ave
East Station Entrance
Secondary Station Building
1,007 Parking sp. (HSR 2040)
~ 9 AC
Building Services & Plant Rooms
Transit Plaza
HSR Platform (side)
HSR Platform (side)
Systems ATC Site Type A
Systems ATC Site Type B
Systems ATC Site Type C
Systems ATC Site Type B
Systems ATC Site Type C
Systems ATC Site Type A
Systems ATC Site Type B
Main Station Building
435 Parking sp. (HSR 2040)
~ 5 AC
West Station Entrance
72 Parking Sp. (HSR 2040)
~ 1 AC
Las Animas Ave
Leavesley Rd
LEGEND
Environmental Footprint
New Station Facilities
New Below Grade Station Facility
HSR Tracks and Platform (Embankment)
Freight Tracks (Embankment)
Vehicular Road (Proposed)
Proposed Surface Parking Facility Total Parking Provided Includes Access Roads, Sidewalks, Landscaping =1,520 spaces for HSR 2040 (~15 AC)
Pickup / Drop-off Area
Street Directional Arrows
Station Entrance
Class I Bike Trail (Proposed by HSR)
Class II Bike Lane (Proposed by HSR)
Class III Bike Route (Proposed by HSR)
Bike Parking (Proposed)
Bus Stop (Proposed)

Source: Authority 2019a

JUNE 2019

Figure 2-63 Conceptual East Gilroy Station Plan (Alternative 3)



Source: Authority 2019a

JUNE 2019

Figure 2-64 Cross Section of East Gilroy Station

Freight or Passenger Rail Modifications

The freight rail modifications would be generally as described for Alternative 1 between Kittery and Cox. Alternative 3 would require a new freight connection to the MOWF.

Land Use and Community Modifications

Alternative 3 would displace residential, commercial, agricultural, and parks and recreation uses.

Pacheco Pass Subsection

The characteristics of the Pacheco Pass Subsection under Alternative 3 would be as described for Alternatives 1 and 2. The Tunnel 2 design variant would be the same as described in Alternative 1.

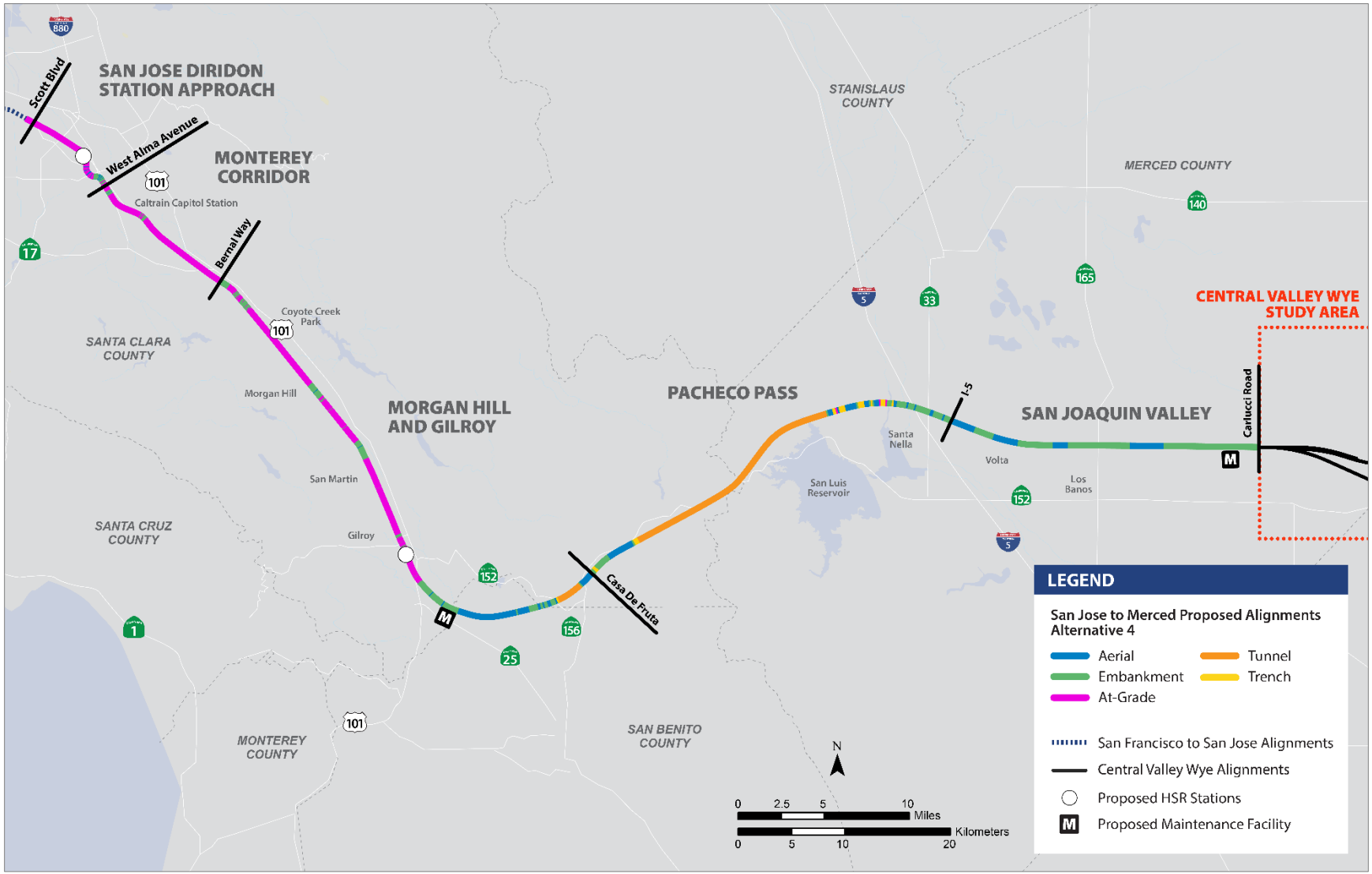
San Joaquin Valley Subsection

The characteristics of the San Joaquin Valley Subsection under Alternative 3 would be as described for Alternatives 1 and 2.

2.6.2.7 Alternative 4 (Preferred Alternative, CEQA Proposed Project)

Rationale

Development of Alternative 4 was intended to extend blended electric-powered passenger railroad infrastructure from the southern limit of Caltrain's PCEP through Gilroy. South and east of Gilroy, HSR would operate on a dedicated guideway similar to that of Alternatives 1 and 2. The objectives of this approach are to minimize property displacements and natural resource impacts, retain local community development patterns, improve the operational efficiency and safety of the existing railroad corridor, and accelerate delivery of electrified passenger rail services in the increasingly congested southern Santa Clara Valley corridor. The alternative is distinguished from the other three project alternatives by a blended, at-grade alignment that would operate on two electrified passenger tracks and one conventional freight track predominantly within the existing Caltrain and UPRR rights-of-way. The maximum train speed of 110 mph in the blended guideway would be enabled by continuous access-restriction fencing; four-quadrant gates, roadway lane channels, and railroad trespass deterrents at all public road grade crossings; and fully integrated communications and controls for train operations, grade crossings, and roadway traffic. Caltrain stations would be reconstructed to enable directional running as part of blended operations. Overall, this alternative would be comprised of 15.2 miles on viaduct, 30.3 miles at grade, 25.9 miles on embankment, 2.3 miles in trench, and two tunnels with a combined length of 15.0 miles. Figure 2-65 illustrates the alignment and track profile of Alternative 4.



Source: Authority 2019a

JUNE 2019

Figure 2-65 Alternative 4 Proposed Alignment

San Jose Diridon Station Approach Subsection

Alignment and Ancillary Features

Alternative 4 would begin at Scott Boulevard in blended service with Caltrain on an at-grade profile following Caltrain MT2 and MT3 south along the east side of the existing Caltrain corridor. The existing Lafayette Street pedestrian overpass would remain in place, as would the De La Cruz Boulevard and West Hedding Street roadway overpasses. New UPRR track would start just south of Emory Street to maintain freight movement capacity north of San Jose Diridon Station. The new UPRR track would be east of Caltrain MT1. The existing Santa Clara Station would remain. The existing College Park Caltrain Station would be reconstructed just north of Emory Street on the west side of the Caltrain Corridor on the existing siding track to eliminate the existing holdout rule at the station. A portion of both legs of the UPRR Warm Springs Subdivision Lenzen Wye would undergo minor track adjustments, and a new bridge would be built over Taylor Street for UPRR to tie into the Lenzen Wye.

The blended at-grade alignment would continue along MT2 and MT3 to enter new dedicated HSR platforms at grade at the center of San Jose Diridon Station (Figure 2-66). HSR platforms would be extended south to provide 1,385-foot and 1,465-foot platforms and would be raised to provide level boarding with the HSR trains. The existing Santa Clara Street underpass would remain, but the track in the throat and yard would require modification. There would be no need for modifications to the VTA light rail.

Continuing south, the blended at-grade three-track alignment would remain in the Caltrain right-of-way through the Gardner neighborhood. The existing underpass at Park Avenue and the existing overpass at San Carlos Street would remain in place. Four-quadrant gates with channelization would be built at Auzerais Avenue and West Virginia Street. A new bridge for the blended HSR/MT3 track over I-280 would be constructed. The existing underpasses at Bird Avenue and Delmas Avenue would be reconstructed, as would the rail bridge overpasses. New standalone rail bridges over Prevost Street, SR 87, the Guadalupe River, and Willow Street would be built for MT3. MT1 and MT2 would remain on the existing structures. The existing Tamien Caltrain Station would remain in place.

Diridon Design Variant

The Authority has developed a DDV that would allow for higher speeds in the approaches and through Diridon Station than the preliminary design for Alternative 4 would provide. The above design is based on the PCEP track geometry and restricts speeds approaching and through the station to 15 mph. The DDV would improve the curvature in the alignment described above to the north of the station between Julian Street and Santa Clara Street and from the south end of the station to San Carlos Street. The design variant would also modify the preliminary design of the ends of the platforms, providing for increased speeds of 40 mph, comparable to the design speeds provided by Alternatives 1, 2, and 3.

North of the station, the design alterations would change the horizontal placement of the freight and electrified passenger tracks up to 37 feet to the east between Santa Clara Street and Julian Street. This would require up to 23 feet of additional property from the SAP parking lot on the east side of the rail corridor and one additional commercial property. In the platform area of San Jose Diridon Station, the HSR southbound track would shift 4 to 10 feet to the east in two discrete areas (one 117 feet long on the north side of the station and the other 92 feet long on the south side), and the platforms would be cut or filled to adjust to the revised alignment. The HSR northbound track would shift up to 2 feet to the west in one discrete area (466 feet long in the southern part of the station), and the platform would be filled to adjust. The two westernmost station tracks (used by Caltrain and occasionally other services) would move up to 5 feet to the west on the southern end of the station. None of the track shifts in the station area would require the acquisition of additional right-of-way. From the south end of the station to San Carlos Street, the design alterations would adjust the horizontal placement of the electrified passenger tracks by up to 1 foot and would not require any additional right-of-way. The VTA light-rail line storage track south of the station would be cut short by about 50 feet to maintain adequate spacing to the HSR mainline tracks (Authority 2020b).

The rationale for the Alternative 4 preliminary design without the DDV was to bring HSR service to San Jose Diridon Station with minimal changes to the PCEP infrastructure, where track geometry restricts speeds approaching and through the station to 15 mph. The Authority developed the DDV to provide design speeds of 40 mph to, from, and through San Jose Diridon Station, comparable to the design speeds provided by Alternatives 1, 2, and 3. The location of the DDV is identified in **Error! Reference source not found.**.

Traction Power Facilities

No traction power facilities would be required in this subsection under Alternative 4 because power would be supplied through PCEP facilities.

Train Control and Communication Facilities

Under Alternative 4, HSR would use the existing ATC sites included as part of the Caltrain Positive Control and Electrification Project.

One standalone communications radio site would be constructed at one of two locations, both south of Scott Boulevard along the east side of the Caltrain corridor.

Wildlife Crossings

There would be no wildlife crossings in this subsection.

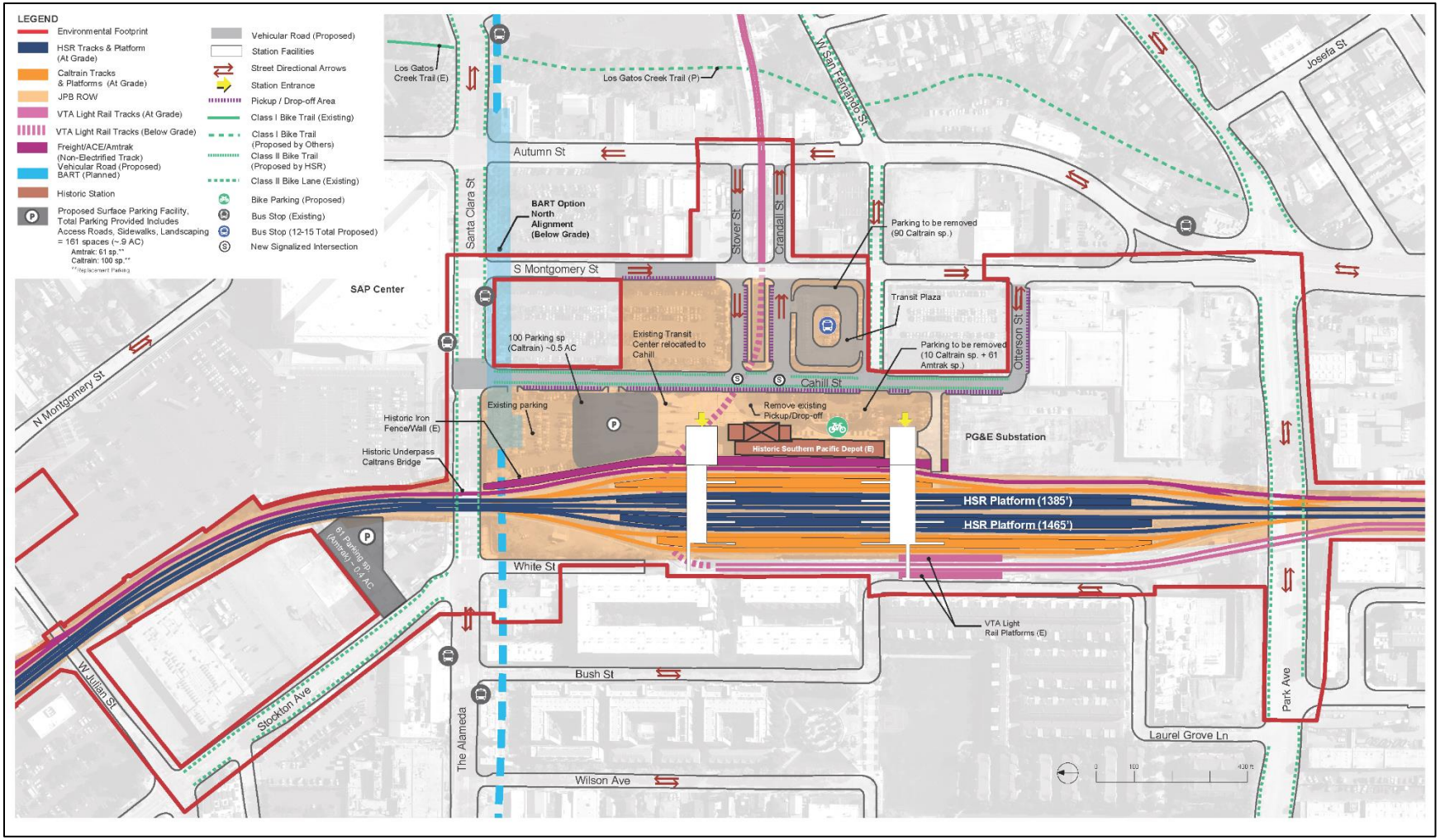
Stations

The San Jose Diridon Station would entail a four-track at-grade alignment through the center of the existing Diridon station, with 1,385- and 1,465-foot platforms centered between Santa Clara Street and Park Avenue (Figure 2-66). The existing historic station would remain in place. A pedestrian concourse would be built above the yard to provide access to the platforms below. The concourse would consist of a pedestrian walkway above the existing Caltrain tracks and below the HSR platforms, with two entrances on the east side and one on the west.

Permanently displaced station parking spaces would be replaced 1:1 in a parking structure at Cahill/Crandall Streets and a second site at Stockton/Alameda Streets. If the Google Downtown West proposed development in the SAP parking lot north of Santa Clara Street is not realized, then the project would displace some existing SAP parking lot spaces and they would be replaced through a parking garage structure north of the SAP Center in the northern part of the existing SAP Center parking lot. If the Google Downtown West proposed development in the SAP parking lot north of Santa Clara is not realized, then the Downtown West project would account for displacement of parking spaces in the SAP Center parking lot, through its plans, which include a requirement to result overall in a net increase in parking available to the SAP Center by 350 spaces and the HSR project would not include the parking structure in the SAP Center parking lot.

The existing on-site/off-street bus transit center would be relocated to an off-street facility between Cahill, Crandall, South Montgomery, and West San Fernando Streets. Street improvements would include reconfiguring and extending Cahill Street from Santa Clara Street to Otterson Street and extending Stover and Crandall Streets to South Montgomery Street. New bike lanes would be installed on the east side of Cahill Street. New signals and pedestrian crossings would be developed at Cahill and Stover Streets and Cahill and Crandall Streets.

Phasing for interim operations (2027) includes a pedestrian overhead crossing (PED OC) south of the existing historic station and would provide circulation access from the PED OC only to HSR platforms. Caltrain would continue to use the existing tunnel for access. Phasing for Valley-to-Valley service (2029) includes access to and from all Caltrain and HSR platforms. At this stage, the existing tunnel would be used only for exiting purposes on HSR platforms. At buildout, there would be an additional PED OC north of the historic station with access to all Caltrain and HSR platforms. From the HSR platforms, the existing tunnel would continue to be used only for exiting.



Source: Authority 2019a

OCTOBER 2021

Figure 2-66 Conceptual San Jose Diridon At-Grade Station Plan (Alternative 4)

Source: Authority 2019a
CEMOF = Centralized Equipment Maintenance and Operation Facility

MARCH 2020

Figure 2-67 Extent of Diridon Design Variant

Maintenance Facilities

No maintenance facilities are proposed in this subsection.

State Highway or Local Roadway Modifications

Appendix 2-A details local road modifications that would be required in this subsection.

Freight or Passenger Rail Modifications

Because Alternative 4 would operate in blended service with Caltrain in the Caltrain/UPRR right-of-way, there would be freight track changes throughout the entire alignment from Scott Road to the South Gilroy MOWF:

- A new rail bridge over West Taylor Street
- Quad gates at Auzerais and West Virginia Street
- Freight track shifted north and east from West Virginia Street to Delmas Avenue
- New rail bridge over Bird and Delmas Avenues

Two track modifications in this subsection could have effects on environmental resources:

- New freight track MT0 along the east side of the alignment from Emory Street to San Jose Diridon Station
- MT1 (nonelectrified freight track) shifted east

To allow for single tracking during construction by VTA LRT, Alternative 4 would install a new crossover with powered switches south of Tamien Station. Power would be provided to existing switches for the four crossovers at the diamond north of Virginia VTA Station, as well as to the existing crossover south of Tamien. Alternative 4 would include signaling for these powered switches.

Land Use and Community Modifications

Alternative 4 would require the acquisition of residential, commercial, and industrial properties in this subsection to obtain adequate right-of-way for construction and operations.

Monterey Corridor Subsection

Alignment and Ancillary Features

The Monterey Corridor Subsection would be approximately 9 miles long and entirely within the San Jose city limits. From the San Jose Diridon Station Approach Subsection at West Alma Avenue just south of the Caltrain Tamien Station, the alignment would extend southeast to Bernal Way (Figure 2-65). Unlike Alternatives 1, 2, and 3, Alternative 4 would be in blended service with Caltrain on an at-grade profile within the Caltrain and UPRR right-of-way. HSR and Caltrain would operate on the electrified MT2 and MT3, while UPRR would operate on a nonelectrified MT1. The two existing tracks would be shifted to accommodate the third track. The existing Tamien Caltrain Station would remain in place with two new electrified turnback tracks constructed south of the station to facilitate turning trains outside the station platform areas. The Michael Yard would be reconfigured to a double-ended facility to accommodate storage of ACE trains and relocated to the east side of the corridor. A new standalone bridge over West Alma Avenue would be constructed for MT3 and a maintenance track, with MT1 and MT2 remaining on the existing structure. A new bridge over Almaden Road would be constructed for MT2 and MT3, while MT1 would remain on the existing structure. The bike path at Almaden Expressway would be realigned to the west in a culvert under the roadway. The existing pedestrian overpass at Communications Hill would remain in place. Capitol Caltrain Station would be reconstructed with a new center platform between MT2 and MT3. The platform would be reached by a new pedestrian overpass built at the north end of the platform. The existing Capitol Expressway overpass would remain in place. Four-quadrant barrier gates with channelization would be built at Skyway Drive, Branham Lane, and Chynoweth Avenue. The existing Blossom Hill Road overpass and adjacent pedestrian overpass would remain in place. The Blossom Hill Caltrain Station would be reconstructed; the existing pedestrian overpass and platform would be removed and a new

center platform constructed between MT2 and MT3. The platform would be reached by a new pedestrian overpass built at the south end of the platform. Great Oaks Parkway would be realigned for approximately 1,350 feet to accommodate the widened rail corridor. SR 85 and Bernal Road overpasses would remain in place.

Traction Power Facilities

One traction power paralleling station would be built on the west side of the Caltrain Corridor near the Blossom Hill Caltrain Station.

Train Control and Communication Facilities

Five ATC sites would be constructed within the subsection at the following locations:

- Near Communications Hill on the east side of the Caltrain corridor near Chateau La Salle Drive
- Near Communications Hill on the east side of the Caltrain corridor near Montecito Vista Way
- Near Monterey Road on the west side of the Caltrain corridor near Capitol Caltrain Station
- Near Skyway Drive on the west side of the Caltrain corridor (two site options)
- Near Branham Lane on the west side of the Caltrain corridor

Two standalone communications radio sites would be built:

- Near Almaden Road on the east side of the Caltrain corridor
- Near Branham Lane on the west side of the Caltrain corridor

PTC sites would be constructed at the following locations:

- Two sites south of Almaden Road
- One site north of Capitol Caltrain Station
- One site co-located with the ATC site at Branham Lane

Wildlife Crossings

There would be no wildlife crossings in this subsection.

Stations

There would be no HSR stations in this subsection.

Maintenance Facilities

No maintenance facilities are proposed in this subsection.

State Highway or Local Roadway Modifications

Appendix 2-A details local road modifications that would be required in this subsection.

Freight or Passenger Rail Modifications

Because Alternative 4 would operate in blended service with Caltrain in the Caltrain/UPRR right-of-way, there would be freight track changes throughout the entire alignment from Scott Road to the South Gilroy MOWF. Four-quadrant gates would be installed at all at-grade crossings. Capitol Station and Blossom Hill Station would have a new center platform and pedestrian underpass. Four track modifications in this subsection could have effects on environmental resources:

- Michael Yard (between West Alma and Almaden Road)—there are additional ACE storage tracks to the east
- MT1 would be shifted east from south of Almaden Expressway to south of Communications Hill
- MT1/freight would be shifted west from Pullman Way to Fehren Drive
- From Fehren Drive south to Bernal, MT1/freight would be shifted to the east of existing freight tracks

Land Use and Community Modifications

Alternative 4 would require the acquisition of residential, commercial, and industrial properties in this subsection to obtain adequate right-of-way for construction and operations.

Morgan Hill and Gilroy Subsection

Alignment and Ancillary Features

The Morgan Hill and Gilroy Subsection under Alternative 4 would be approximately 32 miles long, continuing south from the Monterey Corridor Subsection. From Bernal Way in South San Jose, the alignment would extend through Morgan Hill and San Martin to the Downtown Gilroy Station, then curve generally east across the Pajaro River floodplain and through a portion of northern San Benito County before entering Tunnel 1 at the base of the Diablo Range. The alignment would exit the tunnel at Casa de Fruta Parkway/SR 152 in unincorporated eastern Santa Clara County, where it would transition to the Pacheco Pass Subsection. This subsection under Alternative 4 would be in blended service with Caltrain on an at-grade profile within the Caltrain/UPRR right-of-way with an at-grade Downtown Gilroy Station. Past the Downtown Gilroy Station and south of the US 101 overpass, HSR would enter the fully grade-separated, dedicated track needed to operate HSR trains at speeds faster than 125 mph.

Beginning at the southern limit of the Monterey Corridor Subsection, the alignment would continue in blended service with Caltrain on an at-grade profile in the existing UPRR right-of-way. HSR and Caltrain would operate on the electrified MT2 and MT3 tracks, while UPRR would operate on MT1. A UPRR siding track would be provided between Blanchard Road and Bailey Avenue. Four-quadrant barrier gates would be installed at all existing public road crossings. Intrusion deterrents would be installed at all at-grade crossings. Three private road crossings would be eliminated and alternate access provided to those properties. The existing Bailey Avenue overpass would remain in place. The Monterey Road underpass would be reconstructed to accommodate the future widening of Monterey Road to four lanes. The Morgan Hill Caltrain Station would be reconstructed with two new side platforms built outside MT2 and MT3. The platform would be reached by a new pedestrian underpass built at the north end of the platform. The existing Butterfield Boulevard overpass would remain in place. Upper Llagas Creek bridge would be reconstructed.

The San Martin Caltrain Station would be reconstructed—the existing platform would be removed, and a new center platform would be built between MT2 and MT3. The platform would be reached by a new pedestrian overpass constructed at the south end of the platform. The existing bridge at Miller Slough would be replaced with a triple-cell box. Blended service would end just south of the Downtown Gilroy Station, where Caltrain would have access to turn back and stabling tracks relocated from the station area to south of 10th Street on the west side of the UPRR right-of-way. The Gilroy Caltrain Station would be reconstructed—the existing Caltrain platform would be shifted south and served by a southbound station track. A northbound Caltrain side platform would be provided to the east of a northbound station track. Two side platforms would be provided for HSR on the outside of the MT2 and MT3 tracks. The platforms would be reached by a new pedestrian overpass built over the center of the platforms. HSR would continue south under the US 101 overpass, which would remain in place. Past the Industry spur, HSR would ascend onto embankment and then a bridge over the UPRR. Two bridges would be constructed, one for MT2 and MT3 and one for the MOWF lead track. The UPRR Hollister branch line would be realigned to the west to accommodate HSR bridging over the UPRR tracks at a single location. HSR MT2 and MT3 would descend from the embankment before crossing over Bloomfield Avenue on a new structure. Four-quadrant barrier gates and intrusion deterrents would be installed at Bloomfield Avenue for the MOWF lead track and UPRR service track. HSR would continue past the MOWF and transition to a new viaduct structure to cross over Pajaro Creek. Continuing on viaduct until just west of Millers Canal, Alternative 4 would resume the alignment described for Alternative 1. The Tunnel 1 design variant would be the same as described in Alternative 1.

Tunnel Design Variant

The characteristics of the TDV in the Morgan Hill and Gilroy Subsection under Alternative 4 would be the same as described in the Morgan Hill and Gilroy Subsection under Alternative 1.

Traction Power Facilities

One new TPSS, Site 4—Gilroy, would be constructed at one of two locations on the east side of the alignment: south of Buena Vista Avenue or north of Cohansey Avenue. At this site, one new utility switching station could be co-located with the TPSS. Communication facilities (i.e., redundant fiber optic lines) would also be required to support the electrical interconnections of the TPSS to a new PG&E switching station, to existing PG&E facilities, or both—typically within tie-line/utility corridors.

A traction power switching station would be constructed west of the HSR alignment at Richmond Avenue.

Three traction power paralleling stations would be constructed adjacent to the guideway:

- Either south of San Pedro Avenue on the west side of the alignment or just north of Butterfield Boulevard on the east side of the alignment
- West of Lovers Lane either south of the alignment or north of the alignment (same as Alternative 1)
- Near the Tunnel 1 east portal, either at the portal or east of SR 152 in the southern area of Casa de Fruta (same as Alternatives 1 and 2)

PG&E would reinforce the electric power distribution network to meet HSR traction and distribution power requirements by reconductoring approximately 11.1 miles of existing power line associated with the Spring to Llagas and Green Valley to Llagas 115-kV power lines. The existing power lines to be reconductored, reusing the poles and towers, begin at the Morgan Hill Substation on West Main Avenue in Morgan Hill, then cross the east side of Peak Avenue and Dewitt Avenue, spanning West Dunne Avenue, Chargin Drive, Spring Avenue, and several residences. The alignment would continue south across an open-space area, then follow Sunnyside Avenue for approximately 0.5 mile. The alignment would continue south for approximately 4 miles, spanning additional open-space areas of wineries and the Corde Valley Golf Course. The alignment would then turn east along the north side of Day Road before heading south for approximately 2.5 miles and terminating at the Llagas Substation in Gilroy.

A permanent overhead distribution electrical power line from TPSS Site 4 to the Tunnel 1 portal location would provide power to the TBM during construction and the tunnel fire-life-safety system during operations.

Train Control and Communication Facilities

Twenty-three ATC sites would be constructed:

- One site south of Blanchard Road on the east side of the alignment (two site options)
- Three sites south of Live Oak Avenue on the west side of the alignment
- One site north of San Pedro Avenue on the west side of the alignment
- One site north of Barrett Avenue on the west side of the alignment (two site options)
- One site north of East Middle Avenue on the west side of the alignment
- One site in the vicinity of either Church Avenue or Lena Avenue on the east side of the alignment (two site options)
- One site between Leavesley Road and IOOF Avenue
- Two sites south of Lewis Street on the east side of the alignment
- Two sites south of 6th Street on the west side of the alignment

- Three sites in the vicinity of 10th Street on the east side of the alignment
- Four sites north of Carnadero Avenue on the west side of the alignment
- Two sites east of the Pajaro River
- One site near Lake Road (two site options) (same as Alternative 1)

PTC sites would be constructed at the following locations:

- One site south of Blanchard Road
- One site north of Bailey Avenue
- One site co-located with ATC site south of Live Oak Avenue
- One site at Cohansey Avenue
- One site south of Lewis Street
- One site south of East 6th Street

Five standalone communications radio sites would be constructed:

- Near Bernal Way on the west side of the alignment (two site options)
- South of Live Oak Avenue on the west side of the alignment (two site options)
- In the vicinity of East Central Avenue (two site options, one on either side of the alignment)
- South of California Avenue on the east side of the alignment
- East of the Pajaro River south of Gilroy

Wildlife Crossings

Twelve wildlife crossings or jump-outs would be built in this subsection:

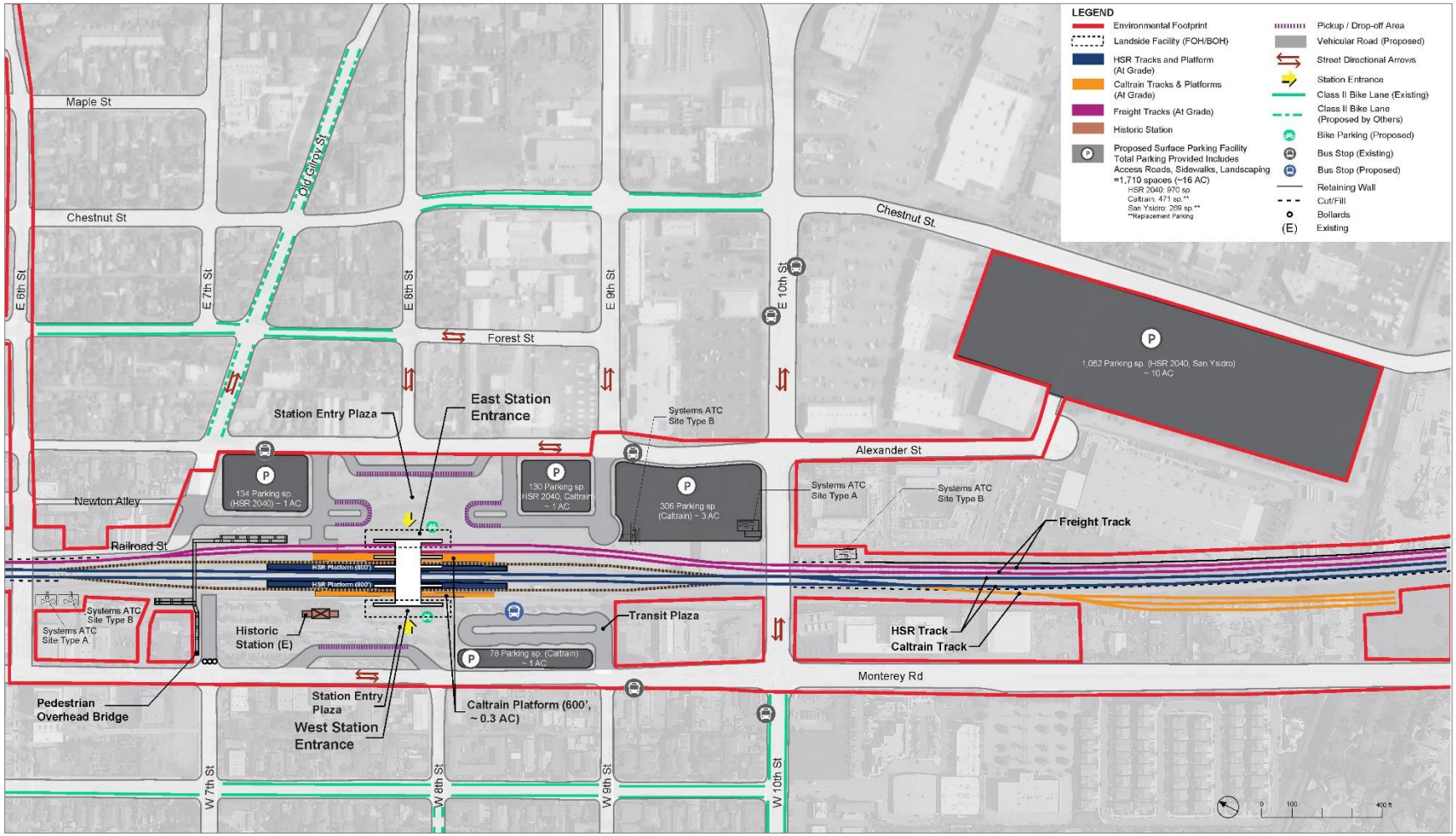
- Three adjacent wildlife crossings with jump-outs integrated into the wing walls at Tulare Hill
- Fisher Creek culvert under UPRR and Monterey Road replaced with a larger box culvert to improve wildlife crossing potential at this location
- Wildlife crossings and integrated jump-outs south of Emado Avenue, south of Fisher Road, and south of Live Oak
- Wildlife crossings at Richmond Avenue, Paquita Espana Court, and north of Kalana Avenue
- Dedicated jump-outs north of Fisher Creek, south of Blanchard Road, north of Kalana Avenue, and at Miramonte Avenue

Wildlife intrusion deterrents would be constructed for at-grade crossings at Blanchard Road, Palm Avenue, Live Oak Avenue, and Bloomfield Avenue.

Stations

The Downtown Gilroy Station approach would be at grade with dedicated HSR tracks to the west of UPRR between Old Gilroy Street/7th Street, which would be closed, and 9th Street (Figure 2-68). A new HSR station with 800-foot platforms would be built south of the existing Caltrain station. A pedestrian concourse would be built above the UPRR and Caltrain tracks to provide access to the platforms below.

The existing 489 Caltrain parking spaces on the west side of the station would be replaced 1:1 in parking lots on the east and west sides of the alignment. The existing 269 parking spaces at the San Ysidro housing development would be replaced 1:1 with new surface parking at the south end of Alexander Street. HSR parking demand would be 970 spaces in 2040, for a total of 1,728 aggregated parking spaces in 2040. The station site plan provides 970 new parking spaces in five areas. One site would be west of the station along Monterey Road at 9th Street. The other four would be on the east side of the station along Alexander Avenue at 7th Street, 9th Street, 10th Street, and Banes Lane. A multimodal access plan would be developed prior to design and construction of the station. The plan would be developed in coordination with local agencies and would include a parking strategy that would specify the location, amount, and phasing of parking.



Source: Authority 2019a

JUNE 2019

Figure 2-68 Conceptual Downtown Gilroy At-Grade Station Plan (Alternative 4)

A total of eight bus bays would be provided, adding one bay to the existing seven. East 7th Street would be closed and East 10th Street would be modified with quadrant gates and channelization. A pedestrian overcrossing would be installed to provide access between East and West 7th Street. A 4,000-square-foot bicycle facility would be built.

The Morgan Hill Caltrain Station would be reconstructed with two new side platforms built outside MT2 and MT3. The platform would be reached by a new pedestrian underpass built at the north end of the platform. The San Martin Caltrain Station would be reconstructed where the existing platform would be removed, and a new center platform would be built between MT2 and MT3. The platform would be reached by a new pedestrian overpass at the south end of the platform.

Maintenance Facilities

The South Gilroy MOWF (Figure 2-43) near Bloomfield Avenue would encompass approximately 50 acres and the program and layout would be as described for Alternatives 1 and 2. In contrast to Alternatives 1 and 2, the MOWF for Alternative 4 would be located on the west side of the tracks between Carnadero Avenue and the Pajaro River. This configuration would require realignment of the UPRR Hollister Subdivision. HSR mainline and MOWF lead track would pass over UPRR Coast Subdivision tracks.

State Highway or Local Roadway Modifications

Appendix 2-A details local road modifications that would be required in this subsection.

Freight or Passenger Rail Modifications

Because Alternative 4 would operate in blended service with Caltrain in the Caltrain/UPRR right-of-way, there would be freight track changes throughout the entire alignment from Scott Road to the South Gilroy MOWF. Four-quadrant gates would be installed at all at-grade crossings. Eight track modifications in this subsection could have effects on environmental resources:

- Eastward shift of freight track from Bernal Avenue to south of Gilroy, except from Tulare Hill to Blanchard Road and Llagas Creek curve, where some westward shifts would be necessary for curve adjustments
- South of Blanchard Road until Bailey Road, a new UPRR siding track east of the existing tracks
- The Redwood Lumber industry spur realigned at Madrone Avenue on the west side of the alignment
- New rail bridge over Monterey Road
- New side platforms and pedestrian underpass at Morgan Hill Station and new center platform and pedestrian overpass at San Martin Station
- Just south of the Downtown Gilroy Station, additional Caltrain storage tracks on the west side of the alignment
- New UPRR siding track at Downtown Gilroy Station; two freight tracks would continue south of US 101
- South of Carnadero Avenue, the UPRR Hollister track realigned to pass under HSR to accommodate the MOWF layout and provide freight access to the MOWF. A crossover just south of Bolsa Road for freight to access the MOWF

Land Use and Community Modifications

Alternative 4 would require the acquisition of residential, commercial, and industrial properties in this subsection to obtain adequate right-of-way for construction and operations.

Pacheco Pass Subsection

The characteristics of the Pacheco Pass Subsection under Alternative 4 would be as described for Alternatives 1, 2, and 3. The Tunnel 2 design variant would be the same as described in Alternative 1.

San Joaquin Valley Subsection

The characteristics of the San Joaquin Valley Subsection under Alternative 4 would be as described for Alternatives 1, 2, and 3.

2.7 Ridership

2.7.1 Travel Demand and Ridership Forecasts

Ridership forecasts were prepared to support ongoing planning for the HSR system and the analysis in this Final EIR/EIS. The forecasts were developed for the 2016 Business Plan by Cambridge Systematics, Inc. using a refined ridership and revenue model, Business Plan Model Version 3. These forecasts were based on two distinct implementation scenarios: (1) a Valley-to-Valley scenario, in which the Silicon Valley to Central Valley Line opens in 2025 and the Phase 1 HSR system opens in 2029, and (2) a Valley-to-Valley extended scenario, in which the Silicon Valley to Central Valley Line opens with an extension to San Francisco and Bakersfield in 2025, and the Phase 1 HSR system opens in 2029. For each scenario, the Business Plan presented high, medium, and low forecasts, reflecting a range of probabilities.[13] Forecasts for each scenario were presented for a range of years from 2025 through 2060.

The ridership forecasts presented in this Final EIR/EIS are based on the Valley-to-Valley implementation scenario from the 2016 Business Plan. Both the medium and high ridership forecasts are used in this Final EIR/EIS. In general, the medium ridership forecast provides for a conservative analysis of project benefits, whereas the high ridership forecast provides for a conservative analysis of adverse impacts.[14] For 2040, the 2016 Business Plan forecasts projected 42.8 million passengers under the medium ridership scenario and 56.8 million passengers under the high ridership scenario (Table 2-13).[15] The 2040 forecasts correspond to the horizon year used for impact analysis in this Final EIR/EIS, which accordingly focuses on the 2040 forecasts.

Table 2-13 High-Speed Rail System Ridership Forecasts (in millions per year)

Forecasts	Phase 1 (2029)	Phase 1 (2040)
Medium	19.3	42.8
High	26.0	56.8

Source: Authority 2016c

The Business Plan Model Version 3 model refined the previous Version 2 model by fully integrating data gathered from the more recent stated preference and preference surveys. The model was further refined by incorporating a new variable that reduced the number of trips involving a relatively long trip to or from the HSR station combined with a relatively short trip on the HSR line itself. This variable reflected the disadvantage and low likelihood of those types of trips. In addition, several other small adjustments related to auto costs and transit networks were made to the model to produce updated forecasts. Additional details regarding the modeling and

[13] The development of the 2016 Business Plan forecasts included a probability assessment, generated though an analytical technique known as Monte Carlo simulations. The Monte Carlo analysis involves running thousands of simulations to assess the likelihood that a given outcome would occur.

[14] For additional detail regarding the use of medium and high ridership forecasts in this Final EIR/EIS, refer to Section 3.1, Introduction.

[15] See 2016 Business Plan, Exhibit 7.1.

forecasts are presented in the *California High-Speed Rail 2016 Business Plan Ridership and Revenue Forecasting: Technical Supporting Document* (Authority 2016e).

This range of ridership forecasts reflects the development of certain aspects of the HSR system's design and certain portions of the environmental analysis, described in more detail in the following subsections. Because the ultimate ridership of the HSR system would depend on many uncertain factors, such as the price of gasoline and population growth, the HSR system described in this document has been designed to accommodate the broad range of ridership expected over the coming decades.

Since the 2016 Business Plan forecasts were developed, the Authority has adopted its 2018 Business Plan, which was accompanied by updated forecasts (Authority 2018). The 2016 and 2018 Business Plan ridership forecasts were developed using the same travel forecasting model; the forecasts differ due to changes in the model's inputs, including the HSR service plan, demographic forecasts, estimates of automobile operating costs and travel times, and airfares. The medium ridership forecast for 2040 decreased by 6.5 percent, from 42.8 to 40 million; and the high ridership forecast decreased by 10.1 percent, from 56.8 to 51.6 million. In addition, the 2018 Business Plan assumes an opening year of 2033 rather than 2029 for the full Phase 1 system.

The Authority released the Revised Draft 2020 Business Plan in February 2021 for public review and comment. The plan was adopted at the April 2021 Board meeting for submittal to the Legislature by May 1, 2021. The 2020 Business Plan forecasts were developed using the same travel forecasting model as the 2016 and 2018 Business Plans, updated for population and employment forecasts. The 2020 Business Plan Phase 1 medium ridership forecast for 2040 is 38.6 million, and the high is 50.0 million (Authority 2021).

To the extent that the lower ridership levels projected in the 2018 Business Plan or the 2020 Business Plan would result in fewer trains operating in 2040, the impacts associated with train operations in 2040 would be somewhat less than the impacts presented in this Final EIR/EIS, and the benefits accruing to the project (e.g., reduced VMT, reduced GHG emissions, reduced energy consumption) would also be less than the benefits presented in this Final EIR/EIS. Like the impacts, the benefits would continue to build and accrue over time and would eventually reach the levels discussed in this Final EIR/EIS for the Phase 1 system.

2.7.2 Ridership and HSR System Design

The HSR system analyzed in this Final EIR/EIS reflects the fact that the system is a long-term transportation investment for the State of California. It is being designed with state-of-the-art infrastructure and facilities that would serve passengers over many decades. While most of the infrastructure components are being designed and built for full utility, certain components are more flexible and can change and adapt to meet ridership as it grows over time.

While the Authority and FRA weighed ridership and revenue potential in evaluating alignment and station alternatives in the Tier 1 Program EIR/EIS documents and Tier 2 alternatives screening, the primary driver influencing design of the HSR system is not the total forecasted annual ridership but rather the performance objectives and safety requirements stipulated by the Authority, FRA, the U.S. Department of Transportation, and the regional transportation partners—including Caltrain, Amtrak, and other operators—whose systems would either use the shared segments of the HSR alignment (blended corridor) or provide connections to HSR.

In keeping with these objectives and requirements, the fully dedicated portion of the alignment comprises a two-track system for most of the right-of-way with four tracks at intermediate stations, regardless of total annual ridership. Track geometry and profile, power distribution systems, train control/signal systems, type of rolling stock, and certain station elements would be the same in both the dedicated and blended corridors regardless of how many riders use the HSR system. The locations of the heavy and light maintenance facilities also follow the mandates stipulated by technical operating requirements rather than ridership.

While the performance objectives and safety requirements are the main factors influencing HSR system design, ridership does influence some aspects of the system's design, including the size of the heavy and light maintenance facilities. The sizes of these facilities are based on the 2040 high-ridership forecast so that these facilities would be sufficient to accommodate maximum future needs. This approach is consistent with general planning and design practices for large infrastructure projects in which resilience and adaptability are incorporated by acquiring enough land for future needs up front rather than trying to purchase property at a later date when it may no longer be available or may be impractical to acquire. The use of ridership forecasts facilitates the early phases of maintenance facility construction as well as subsequent expansion of the facility as fleet size and maintenance requirements grow.

Forecasted annual ridership and peak-period ridership also play a role in determining the size of some station components, such as the size of the public accessway/egressway to the HSR system. The 2040 high-ridership forecast formed the basis for the conceptual service plan, which in turn influenced station site planning by designing station facilities to be sufficient to accommodate the anticipated increase over time of HSR use.

The 2040 high-ridership scenario was also used, along with local conditions, to determine the maximum amount of parking needed at each station. Parking demand and supply were analyzed by considering many factors—including ridership demand, station area development opportunities, and availability of alternative multimodal access improvements—to inform the size of the parking facilities at each station and the anticipated schedule for the phased implementation of these facilities. The use of the 2040 high-ridership scenario provides flexibility to change or even reduce the amount of station parking as these factors become more defined and resolved over time.

2.7.3 Ridership and Environmental Impact Analysis

The forecasts of annual HSR ridership play a role in the analysis of environmental impacts and benefits related to traffic, air quality, noise, and energy. This Final EIR/EIS uses both the medium- and high-ridership forecasts for analyzing potential adverse environmental impacts and environmental benefits of operating the HSR system. This is discussed in more detail in Section 3.1.5.6., Environmental Consequences.

2.7.4 Ridership and Station Area Parking

HSR system ridership, parking demand, parking supply, and development around HSR stations are intertwined and would evolve as ridership increases up to as many as 56.8 million passengers in 2040 when the HSR system is in full operation. To attract, support, and retain high ridership levels, the Authority is working with transportation service providers and local agencies to promote TOD around HSR stations and expand multimodal access to the HSR system.

The implementation of these activities would vary at each station because some cities and regions would be able to develop their station areas and local transit systems faster than others by the 2029 start-up of HSR revenue service and before 2040 when the HSR system would be fully operational. In addition, parking demand and supply at each station would also be affected by technological advances, such as multimodal trip planning/payment software and autonomous vehicles, as well as changes in the bundle of services available to consumers, such as ride-hailing services and bike- and car-sharing programs.

Research suggests that the percentage of transit passengers arriving at and departing from transit stations by car and needing parking accommodations decreases as development and population around the stations increases. The Authority has adopted station-area development policies that recognize the inverse relationship between parking demand and HSR station-area development. In keeping with these policies, the Authority is working with regional planners and planners in the station cities to maximize the success of the HSR system by locating stations in areas where there is, or would be, a high density of population, jobs, commercial development, entertainment venues, and other activities that generate trips. Encouraging development in

high-density areas around HSR stations would allow the Authority to attain its dual goal of supporting system ridership while reducing parking demand.

However, development around HSR stations would not occur immediately. Although the HSR system would be a catalyst for development, actual construction would be dictated by local land use decisions and market conditions. The Authority would work in partnership with local governments and landowners to encourage complementary station-area development, exemplified by the station-area planning funding agreements it has provided to the City of San Jose and the City of Gilroy, but its power in this regard is limited. Consequently, the factors that determine actual parking demand and supply are dependent primarily on local decisions and local conditions.

In light of the uncertainty regarding the need for station-area parking, this Final EIR/EIS conservatively identifies parking facilities for the Gilroy Station based on the maximum forecast for parking demand, the local conditions affecting access planning, and practical means for delivering required parking. This approach identifies the upper range of actual needs for the Gilroy Station and the maximum potential environmental impacts of that range. For the San Jose Diridon Station, the Authority is not proposing to construct new parking to meet new parking demand due to HSR ridership; instead, it is assumed that new parking demand would be met by existing public and commercial parking in the general vicinity of the Diridon Station.

The Authority, in consultation with the City of Gilroy, would have the flexibility to make decisions regarding which parking facilities would be constructed initially and how additional parking can be phased in or adjusted depending on how HSR system ridership increases over time. For example, some parking facilities could be constructed at the 2029 project opening and subsequently augmented or replaced in whole or in part based on future system ridership, station-area development, and parking management strategies. A multimodal access plan would be developed for both the Gilroy and Diridon Station prior to the design and construction of parking facilities at the Gilroy Station and prior to construction of access plans for the Diridon Station. These plans would be prepared in coordination with local agencies and would include a strategy that addresses and informs the final location, amount, and phasing of parking at the Gilroy Station and multimodal access at both stations.

The Authority estimated rail, bus, auto, walk, and bike passenger access and egress trips for year 2040 for all stations, with an additional year 2029 analysis for the San Jose Diridon Station (Authority 2016f).[16] The auto mode share included estimates for pick-up and drop-off, drive and park, rental car, and taxi/shuttle/transportation network company travel modes. Parking demand was estimated based on auto drive and park mode share, while the proposed parking supply at the Gilroy Station accommodates demand to the extent that local policies and station area conditions permit. At the San Jose Diridon Station, as analyzed in Section 3.2, Transportation, the Authority concluded that new parking demand could be met through existing public and commercial parking when considering planned Caltrain and BART expansion of transit access to the Diridon Station Existing on-site parking at the San Jose Diridon Station that would be displaced by the HSR station would be replaced at a 1:1 ratio; temporarily displaced parking would be replaced at a 1:1 basis during construction and permanently displaced parking would be replaced prior to initial HSR operations.

[16] The Authority collected local station area data to prepare a Mode of Access Memorandum for each station (Authority 2016f). Data collection involved touring station areas, consulting local agencies, and reviewing local plans and policies. The memoranda were shared with the local jurisdictions in the station cities.

2.8 Operations and Service Plan

2.8.1 HSR Service

The conceptual HSR service plan for Phase 1 describes service from Anaheim/Los Angeles through the Central Valley from Bakersfield to Merced and northwest into the Bay Area, terminating in San Francisco. Subsequent stages of the HSR system include a southern extension from Los Angeles to San Diego via the Inland Empire and an extension from Merced north to Sacramento.

Train service would run in diverse patterns between various terminals. Three basic service types are envisioned:

- Express trains would serve major stations only, providing fast travel times between Los Angeles and San Francisco during the morning and afternoon peak.
- Limited-stop trains would skip selected stops along a route to provide faster service between stations.
- All-stop trains would focus on regional service.

Most trains would provide limited-stop services and offer a relatively fast run time along with connectivity among various intermediate stations. Numerous limited-stop patterns would be provided to achieve a balanced level of service at the intermediate stations. The service plan envisions at least four limited-stop trains per hour in each direction, all day long, on the main route between San Francisco and Los Angeles. Each intermediate station in the Bay Area, the Central Valley between Fresno and Bakersfield, Palmdale in the high desert, and Sylmar and Burbank in the San Fernando Valley would be served by at least two limited-stop trains every hour—offering at least two reasonably fast trains an hour to San Francisco and Los Angeles. Selected limited-stop trains would be extended south of Los Angeles as appropriate to serve projected demand.

Including the limited-stop trains on the routes between Sacramento and Los Angeles and between Los Angeles and San Diego, and the frequent-stop local trains between San Francisco and Los Angeles/Anaheim and between Sacramento and San Diego, every station on the HSR system would be served by at least two trains per hour per direction throughout the day and at least three trains per hour during the morning and afternoon peak periods. Stations with higher ridership demand would generally be served by more trains than those with lower estimated ridership demand.

The service plan provides direct train service between most station pairs at least once per hour. Certain routes may not always be served directly, and some passengers would need to transfer from one train to another at an intermediate station, such as Los Angeles Union Station, to reach their final destination. Generally, the Phase 1 conceptual operations and service plans would offer a wide spectrum of direct-service options and minimize the need for passengers to transfer.

In 2029, the assumed first year of HSR operation, two trains per hour would operate during peak and one train per hour off-peak between San Francisco and Bakersfield. When Phase 1 operations occur, this Final EIR/EIS assumes the following service:

- Two peak trains per hour from San Francisco and Los Angeles (one in off-peak)
- Two peak trains per hour from San Francisco and Anaheim (one in off-peak)
- Two peak trains per hour from San Jose and Los Angeles
- One peak train per hour from Merced and Los Angeles
- One train per hour (peak and off-peak) from Merced and Anaheim

Total daily operations for the Project Section are detailed in Table 2-14.

Table 2-14 Total Daily Operations—San Jose to Merced Project Section

Service Description	2029	2040
Non-Revenue Trains		
Between MOWF and Gilroy	0	0
Between MOWF and San Jose	0	0
Between MOWF and Merced	0	0
Revenue Trains		
Trains per peak hour (max, one-way)	2	7
Trains per off-peak hour (max, one-way)	1	4
Trains per peak period per day (max)	24	80
Trains per off-peak period per day (max)	24	96
Number of daytime operations: 7 a.m. to 10 p.m. (max)	40	148
Number of nighttime operations: 10 p.m. to 7 a.m. (max)	8	28
Total Trains by Segment		
Trains per peak hour (max, one-way)	2	7
Trains per off-peak hour (max, one-way)	1	4
Trains per peak period per day (max)	24	80
Trains per off-peak period per day (max)	24	96
Number of daytime operations: 7 a.m. to 10 p.m. (max)	40	148
Number of nighttime operations[1]: 10 p.m. to 7 a.m. (max)	8	28
Total Trains All Segments		
Trains per peak period per day (max)	24	80
Trains per off-peak period per day (max)	24	96
Number of daytime operations: 7 a.m. to 10 p.m. (max)	40	148
Number of nighttime operations: 10 p.m. to 7 a.m. (max)	8	28
Total Daily Operations	48	176

[1] No revenue trains would operate between midnight and 6am
max = maximum
MOWF = maintenance of way facility

2.8.2 Maintenance Activities

The Authority would regularly perform maintenance along the track and railroad right-of-way as well as on the power systems, train control, signalizing, communications, and other vital systems required for the safe operation of the HSR system. Maintenance methods are expected to be similar to those of existing European and Asian HSR systems, adapted to the specifics of the California HSR. However, the FRA will specify standards of maintenance, inspection, and other items in a set of regulations (i.e., Rule of Particular Applicability) to be issued in the next several years, and the overseas practices may be amended in ways not currently foreseen. The brief

descriptions of maintenance activities provided in this section are thus based on best professional judgment about future practices in California.

2.8.2.1 Track and Right-of-Way

The track at any point would be inspected several times each week using measurement and recording equipment aboard special measuring trains. These trains are of similar design to the regular trains but would operate at a lower speed. They would run between midnight and 5 a.m. and would usually pass over any given section of track once in the night.

Most adjustments to the track and routine maintenance would be accomplished in a single night at any specific location with crews and material brought by work trains along the line. When rail resurfacing (i.e., rail grinding) is needed, perhaps several times a year, specialized equipment would pass over the track sections at 5 to 10 mph.

Approximately every 4 to 5 years, ballasted track would require tamping. This more intensive maintenance of the track uses a train with a succession of specialized cars to raise, straighten, and tamp the track, using vibrating “arms” to move and position the ballast under the ties. The train would typically cover a 1-mile-long section of track in the course of one night’s maintenance. Slab track, the support type anticipated at elevated sections, would not require this activity. No major track components are expected to require replacement through 2040.

Other maintenance of the right-of-way, aerial structures, culverts, drains, and bridge sections of the alignment would include culvert and drain cleaning, vegetation control, litter removal, and other inspection. Such activities would typically occur monthly to several times a year.

2.8.2.2 Power

The OCS along the right-of-way would be inspected nightly, with repairs being made when needed; these would typically be accomplished during a single night maintenance period. Other inspections would be made monthly. Many of the functions and status of substations and smaller facilities outside the trackway would be remotely monitored. However, visits would be made to repair or replace minor items and would also be scheduled several times a month to check the general site. No major component replacement for the OCS or the substations is anticipated through 2040.

2.8.2.3 Structures

Visual inspections of the structures along the right-of-way and testing of fire/life safety systems and equipment in or on structures would occur monthly, while inspections of all structures for structural integrity would be conducted at least annually. Steel structures would require painting every several years. Repair and replacement of lighting and communication components of tunnels and buildings would be performed on a routine basis. No major component replacement or reconstruction of any structures is anticipated through 2040.

2.8.2.4 Signaling, Train Control, and Communications

Inspection and maintenance of signaling and train control components would be guided by FRA regulations and standards to be adopted by the Authority. Typically, physical in-field inspection and testing of the system would be conducted four times a year using hand-operated tools and equipment. Communication components would be routinely inspected and maintained, usually at night, although daytime work may be undertaken if the work area is clear of the trackway. No major component replacement of these systems is anticipated through 2040.

2.8.2.5 Stations

Each station would be inspected and cleaned daily. Inspections of the structures, including the platforms, would be conducted annually. Inspections of other major systems, such as escalators, the heating and ventilation system, ticket-vending machines, and closed-circuit television, would be performed according to manufacturer recommendations. Major station components are not anticipated to require replacement through 2040.

2.8.2.6 Perimeter Fencing and Intrusion Protection

Fencing and intrusion protection systems would be remotely monitored, as well as periodically inspected. Maintenance would take place as needed; however, fencing and intrusion protection systems are not anticipated to require replacement before 2040.

2.9 Additional High-Speed Rail Development Considerations

2.9.1 High-Speed Rail, Land Use Patterns, and Development Around High-Speed Rail Stations

Prop 1A, approved by voters in 2008, required that HSR stations "be located in areas with good access to local mass transit or other modes of transportation and further required that the HSR system be planned and constructed in a manner that minimizes urban sprawl and impacts on the natural environment" including "wildlife corridors." The Authority embraced these policies in Prop 1A by adopting *HST Station Area Development: General Principles and Guidelines* on February 3, 2011 (Authority 2011). The purpose of the guidance was to provide "international examples where cities and transit agencies have incorporated sound urban design principles as integral elements of large-scale transportation systems."

San Jose and Gilroy have both received station area planning grants to meet the purposes outlined in the 2011 guidelines. In addition, the station area development guidelines stated, "the attention paid to the 'edges' and interface between improvements … will greatly determine the character and function of the station as a 'place'." Typical issues concerning this 'edge' or interface that are addressed in station planning include:

- Coordination of architectural design of station area infrastructure components with surrounding context
- High-quality pedestrian connections to and from station and into the surrounding community
- Traffic calming and high-quality aesthetic design of station district streets
- Preservation of important view corridors
- Design and provision of station district signage and wayfinding
- Design and provision of station district open space

Realizing the potential transportation, community, environmental, and economic benefits of HSR stations for surrounding land uses, final station design would involve Authority collaboration with rail operators, local stakeholders, and land partners to complement transit-oriented and other station-supportive development.

2.9.2 Right-of-Way Acquisition for Construction, Operations, and Maintenance of High-Speed Rail

TCEs and permanent acquisition of right-of-way would be required to construct and operate the HSR system. In building any large, modern transportation project, the displacement of a small percentage of the population is often necessary. However, it is the policy of the Authority that displaced persons not suffer unnecessarily as a result of a program that, like the HSR project, is designed to benefit the public as a whole. Individuals, families, businesses, farms, and nonprofit organizations displaced by the project may be eligible for relocation advisory services and payments. The purpose of the Uniform Act is to provide for uniform and equitable treatment of persons displaced from their homes, businesses, farms, or nonprofit organizations by federal and federally assisted programs and to establish uniform and equitable land acquisition policies for federal and federally assisted programs. Table 2-15 shows the total extent of acquisitions required for the project. Permanent acquisitions do not necessarily involve relocations because some are only partial acquisitions. A detailed analysis of displacements and relocations is presented in Section 3.12, Socioeconomics and Communities and is based on the Draft Relocation Impact Report.

Table 2-15 Right-of-Way Acquisitions

Acquisition Type	Alternative 1	Alternative 2**	Alternative 3	Alternative 4
Temporary Construction Easements (acres)				
Residential use*	50.5	194.6 (194.7)	71.2	60.9
Commercial use	47.5	72.8	21.7	31.2
Mixed use	14.1	32.7	3.2	5.9
Industrial use	157.9	195.0 (192.8)	144.1	50.9
Public facilities	23.8	29.9 (30.5)	10.4	6.8
Transportation use	21.4	25.6	25.5	1.5
Agriculture use	715.1	743.0	798.6	555.8
Open space/parks	491.1	517.7	455.9	420.4
Permanent Right-of-Way Acquisition (acres)				
Residential use	53.0	113.4	55.7	83.7
Commercial use	87.4	104.7	43.3	115.5
Mixed use	15.4	23.5	0.9	26.5
Industrial use	113.0	162.6 (161.7)	77.5	124.2
Public facilities	122.8	126.4 (125.9)	31.2	14.5
Transportation use	28.5	32.1	32.1	28.2
Agriculture use	1,133.3	1,234.6	1,417.7	1,145.1
Open space/parks	1,443.3	1,511.0	1,425.8	1,465.3

Sources: Authority 2019a; City of Santa Clara 2010; City of San Jose 1995, 2011; County of Santa Clara 1994; City of Morgan Hill 2016; City of Gilroy 2002, 2005; County of Merced 2013; County of San Benito 2015

* Some land uses designated as agricultural in the project extent also contain rural residential uses

** Alternative 2 has two Skyway Drive design variants: Alternative 2 Skyway Drive Variant A is presented first and Variant B is shown in parentheses.

2.10 Construction Plan

This section describes the Authority's phased implementation strategy for building the HSR system and summarizes the general approach to activities typically associated with pre-construction and construction of major system components. Additional detail is provided in Appendix 2-L. The construction plan is based on the phased implementation strategy for Phase 1 of the HSR system as described in the Authority's 2018 Business Plan, which assumes that:

- HSR early service from San Francisco to Gilroy would be operational in 2027.
- HSR Valley-to-Valley service would be operational in 2029.
- Phase 1, which would connect San Francisco with Los Angeles via the Central Valley, would be operational by 2033.
- Phase 2, which would subsequently extend service to Sacramento and San Diego for full system operation, would occur after the 2040 Phase 1 system operations envisioned in the Final EIR/EIS.

Table 2-16 shows the generalized approach to project construction. Construction would likely proceed concurrently along the entire project extent. Construction would occur over multiple phases between 2022 and 2028 with approximately 1.5 years of continuous construction activity at any one location. Construction would occur 5 days a week with 8-hour days (250 days per year), except for construction of the Pacheco Pass tunnels, which would occur 7 days a week, 24

hours per day. In addition to the standard construction period, 2 years of additional construction would be required after the initial Phase I startup to reconductor the existing Spring to Llagas and Green Valley to Llagas PG&E power lines. This work would begin in 2030 and would be completed within an approximately 24-month timeframe. Construction within the GEA would not occur at night (1 hour before sunset to 1 hour after sunrise).

The assumed Phase 1 opening year for purposes of the construction plan differs by 4 years from the Phase 1 opening year discussed in Section 2.7. As explained in Section 2.7.1, the ridership forecasts used in this document are derived from the 2016 Business Plan and assume a 2029 opening year for Phase 1. If the actual opening year is later (e.g., 2033), there would be an incremental reduction but not a material change in operational impacts and benefits in 2040 as described in Chapter 3. The 2033 Phase 1 opening year, on the other hand, represents the more appropriate assumption for purposes of the construction plan and evaluating construction-related impacts. The document therefore uses both opening year assumptions.

2.10.1 General Approach

The Authority would begin implementing its construction plan after receiving the required environmental approvals and permits and securing funding. Given the size and complexity of the HSR project, the design and construction work could be divided into several procurement packages. In general, the procurement packages would be grouped as follows:

- Tunnels
- Civil/structural infrastructure, including at-grade, viaduct, and trench track profiles; utility relocations; and roadway modifications
- Design and construction of passenger stations, maintenance facilities, and wayside facilities
- Rail infrastructure and testing including trackwork; design and construction of direct fixation track and subballast; ballast; ties and rail installation; switches; and special trackwork core systems, such as traction power, train controls, communications, the operations center, and procurement of trainsets

One or more design-build packages would be developed. The Authority would issue construction requests for proposals, begin right-of-way acquisition, and procure construction management services to oversee physical construction of the project. During peak construction periods, work would occur concurrently in different subsections, with overlapping construction of various project elements.

Table 2-16 Overall Construction Schedule

Activity	2021	2022	2023	2024	2025	2026	2027	2028	2029
Tunneling									
Right-of-way acquisition	– – X	X X	X X	X X	X –	– –	– –	– –	– –
Environmental remediation	– –	– X	X X	X X	X	– –	– –	– –	– –
Design	– –	– X X	X X	X – –	– –	– –	– –	– –	–
Mobilization	– –	X –	– –	– –	–	– –	– –	– –	– –
Demolition	– –	– X	X – –	– –	– –	– –	– –	– –	– –
Clear and grub	– –	– X	X – –	– –	– –	– –	– –	– –	– –
Site preparation/earthwork	– –	– X	X X	X –	– –	– –	– –	– –	– –
Portals	– –	X X	X X	X –	– –	– –	– –	– –	– –
Tunnels	– –	– X X	X X	X X	X X	X X	X –	– –	– –
Roadbed preparation	– –	X X	X X	X X	X X	X X –	– –	– –	– –
Demobilize	– –	– –	– –	– –	X X	X X	X X	X X –	– X
At-Grade, Viaduct, and Trench									
Right-of-way acquisition	X X	X X	X –	– –	– –	– –	– –	– –	– –
Environmental remediation	– – X	X X	X X –	– –	– –	– –	– –	– –	– –
Design	X X	X –	– –	– –	– –	– –	– –	– –	– –
Mobilization	– –	– X	– –	– –	– –	– –	– –	– –	– –
Utilities relocation	– –	– X	X –	– –	– –	– –	– –	– –	– –
Street/highway preparation	– –	– –	– X	X X	X –	– –	– –	– –	– –
Demolition	– –	– –	X –	– –	– –	– –	– –	– –	– –
Clear and grub	– –	– –	X –	– –	– –	– –	– –	– –	– –
Earthwork	– –	– –	X X	X X	X –	– –	– –	– –	– –
Viaduct	– –	– –	X X	X X	X –	– –	– –	– –	– –
At-grade and below-grade cross sections (incl. stations)	– –	– –	X X	X X	X –	– –	– –	– –	– –
Demobilize	– –	– –	– –	– –	– X	– –	– –	– –	– –

Activity	2021	2022	2023	2024	2025	2026	2027	2028	2029
Rail Infrastructure and Testing									
Mobilization	– –	– –	– –	– X	– –	– –	– –	– –	– –
Track, signal, and traction power construction	– –	– –	– –	– X	X –	– –	– –	– –	– –
Static testing	– –	– –	– –	– –	– X –	– –	– –	– –	–
Dynamic testing	– –	– –	– –	– –	– X	– –	– –	– –	– –
Full speed testing	– –	– –	– –	– –	– X	– –	– –	– –	– –
Demobilize	– –	– –	– –	– –	– – X	– –	– –	– –	–
Stations and Maintenance Facilities									
Right-of-way acquisition	X X	X X	X –	– –	– –	– –	– –	– –	– –
Design	– –	– –	– X	– –	– –	– –	– –	– –	– –
Mobilization	– –	– –	– – X	X –	– –	– –	– –	– –	–
Temporary facilities and track	– –	– –	– –	X –	– –	– –	– –	– –	– –
Building demolition	– –	– –	– –	– X –	– –	– –	– –	– –	–
Building structures and rough systems	– –	– –	– –	– X	X –	– –	– –	– –	– –
Building finish	– –	– –	– –	– – X	X –	– –	– –	– –	–
Remove/restore temporary facilities and track	– –	– –	– –	– X	X –	– –	– –	– –	– –
Demobilize	– –	– –	– –	– –	– X	– –	– –	– –	– –
Assumed Milestones per High-Speed Rail									
Record of Decision (end of 2020)	– –	– –	– –	– –	– –	– –	– –	– –	– –
Monterey Viaduct (start June 2023)	– –	– –	– X X –	– –	– –	– –	– –	– –	– –
Service Central Valley to San Jose (end of 2029)	– –	– –	– –	– –	– –	– –	– –	– –	– X
Service San Francisco to Gilroy (start of 2027)	– –	– –	– –	– –	– –	– –	X – –	– –	– –
San Francisco to San Jose begins June 2021 (San Francisco to San Jose Record of Decision March 2021)	– X –	– –	– –	– –	– –	– –	– –	– –	– –

X = activity; – = no activity

Working hours and the number of workers present at any time would depend on the activities being performed. Construction fencing would be restricted to areas designated for construction staging and areas where public safety or environmentally sensitive resources are a concern.

Consistent with the California High-Speed Rail Authority Sustainability Policy (Authority 2016g), the Authority will continue to implement sustainability practices that inform and affect the planning, siting, designing, construction, mitigation, operation, and maintenance of the HSR system. The Authority is committed to:

- Net-zero greenhouse gas and criteria pollutant emissions in construction
- Operating the system entirely on renewable energy
- Net-Zero Energy, LEED Platinum Facilities
- Planning for climate change adaptation and resilience
- Prioritizing life-cycle considerations

Applicable design standards, including compliance with laws, regulations, and industry standard practices, are included in Appendix 2-D and are considered a part of the project.

2.10.2 Pre-Construction Activities

2.10.2.1 Operational Right-of-Way

During final design, the Authority and its contractor would conduct several pre-construction activities to optimize construction staging and management. These activities include the following:

- Conducting geotechnical investigations to define precise geologic, groundwater, and seismic conditions along the alignment. The results of this work would guide final design and construction methods for foundations, underground structures, tunnels, stations, grade crossings, aerial structures, systems, and substations.
- Identifying construction laydown and staging areas used for mobilizing personnel, stockpiling materials, and storing equipment for building HSR or related improvements. In some cases, these areas would also be used to assemble or prefabricate components of guideway or wayside facilities before transport to installation locations. Precasting yards would be identified for the casting, storage, and preparation of precast concrete segments; temporary spoil storage; workshops, and the temporary storage of delivered construction materials. Field offices and temporary jobsite trailers would also be located at the staging areas. Construction laydown areas are part of the project footprint that is evaluated for potential environmental impacts; however, actual use of the area would be at the discretion of the design-build contractor. After completing construction, the staging, laydown, and precasting areas would be restored to pre-construction condition.
- Initiating site preparation and demolition, such as clearing, grubbing, and grading, followed by the mobilization of equipment and materials. Demolition would require strict controls so that adjacent buildings, infrastructure, natural or community resources are not damaged or otherwise affected by the demolition efforts.
- Relocating utilities prior to construction. The contractor would work with the utility companies to relocate or protect in place high-risk utilities, such as overhead tension wires, pressurized transmission mains, oil lines, fiber optical conduits or cables, and communications lines or facilities, prior to construction.
- Implementing temporary, long-term, and permanent road closures to reroute or detour traffic away from construction activities. Handrails, fences, and walkways would be provided for the safety of pedestrians and bicyclists.
- Siting temporary batch plants to produce Portland cement concrete or asphaltic concrete needed for roads, bridges, aerial structures, retaining walls, and other large structures. The facilities generally consist of silos containing fly ash, lime, and cement; heated tanks of liquid asphalt; sand and gravel material storage areas; mixing equipment; aboveground storage tanks; and designated areas for sand and gravel truck unloading, concrete truck loading, and

concrete truck washout. The contractor would implement procedures for reducing air emissions, mitigating noise impacts, and controlling the discharge of potential pollutants into storm drains or watercourses from the use of equipment, materials, and waste products.

- Conducting other studies and investigations, as needed, such as surveys of local business, farms or dairies, and wildlife refuges to identify usage, delivery, shipping patterns, and critical times of the day or year for business, planting, harvesting activities, or recreational activities. This information would help develop construction requirements and worksite traffic control plans and would help to identify potential alternative routes. Other studies would include necessary cultural resource investigations, historic property surveys, and wildlife surveys.

Table 2-17 identifies potential construction staging and precasting yards included in the preliminary engineering design. Alternatives 1 and 3 would each require three precasting yards to produce the aerial spans for construction of the approximately 22 miles of viaduct along Monterey Road. Alternative 2 would not require precasting yards, but it would require more construction staging areas to accommodate the additional embankment construction and local roadway modifications required for this alternative. Alternative 4 would require the fewest construction staging areas. In addition to the sites identified in Table 2-17, construction staging and assembly of TBMs would occur at the tunnel portals.

Table 2-17 Construction Staging and Precasting Yards by Alternative

Type	Size	Jurisdiction	Location	Alternative			
				1	2	3	4
San Jose Diridon Station Subsection							
Staging	9 acres	San Jose	North of West Julian St, between Caltrain/UPRR and New Montgomery St	X	X	X	
Staging	8.4 acres	Santa Clara	East of Lafayette St				X
Monterey Corridor Subsection							
Precast	67.2 acres	San Jose	Between Hillsdale Ave, Caltrain/UPRR, Capitol Expressway, and Snell Ave	X		X	
Staging	15 acres	San Jose	Between Hillsdale Ave, Caltrain/UPRR, and Granite Rock Way		X		
Staging	Two 1.4-acre sites	San Jose	East Capitol Expressway	X	X	X	
Staging	Two 1.7-acre, one 2.3-acre, and one 1.8-acre sites	San Jose	Blossom Hill Road	X	X	X	
Morgan Hill to Gilroy Subsection							
Staging	11.6 acres	San Jose	East of the Monterey Rd and Emado Ave intersection	X		X	
Staging	Two 4.8- and 2.4-acre sites	San Jose	East of the Monterey Rd and Emado Ave intersection		X		
Staging	7.1 acres	San Jose	Southeast of the Monterey Rd and Bailey Ave interchange		X		
Staging	6 acres	San Jose	Southwest of Bailey Ave				X
Staging	2.4 acres	San Jose	East of Monterey Rd, between Laguna Ave and Richmond Ave		X		

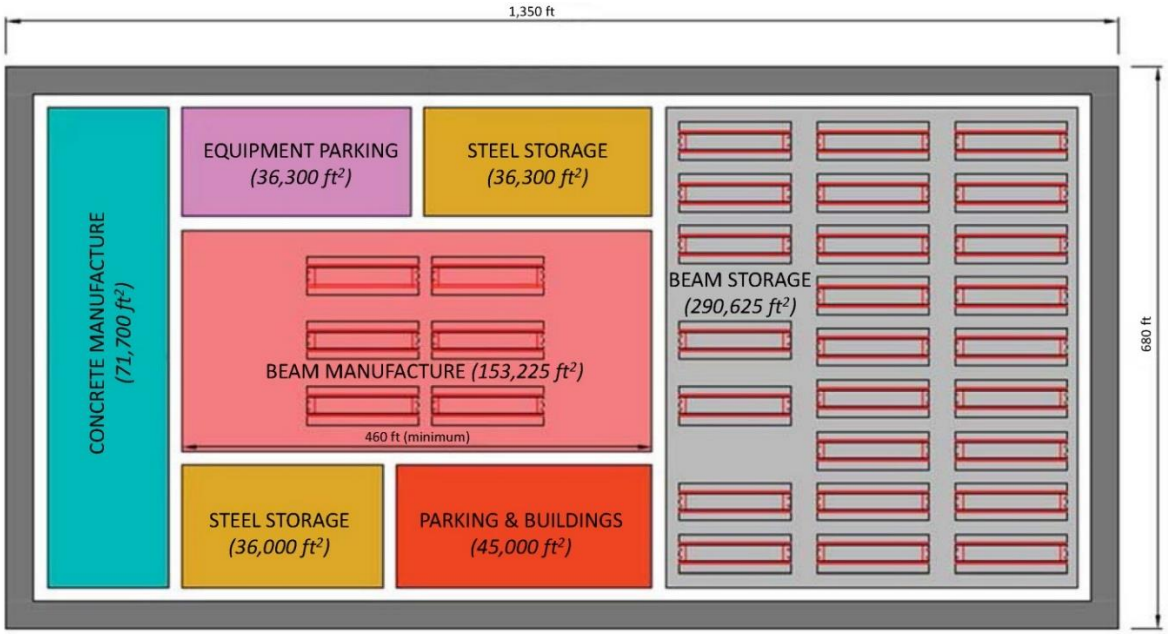
Type	Size	Jurisdiction	Location	Alternative			
				1	2	3	4
Staging	Two 3.6- and 9.9-acre sites	Santa Clara County	East of Monterey Rd at Ogier Ave and Barnhart Ave, respectively		X		
Staging	13.2 acres	Santa Clara County	East of Monterey Rd and north of the intersection with Barnhart Ave	X		X	
Precast	78.1 acres	San Jose	East of the Monterey Rd and Live Oak Ave intersection	X		X	
Staging	13.9 acres	San Jose	East of the Monterey Rd and Live Oak Ave intersection		X		
Staging	29.8 acres	San Jose and Morgan Hill	Northeast of Burnett Ave intersection with Monterey Rd		X		
Staging	0.7 acre	Morgan Hill	Southwest of the US 101 and Cochrane Rd intersection	X		X	
Staging	1.6 acres	Morgan Hill	Between Monterey Rd and Butterfield Blvd, just north of East Central Ave		X		
Staging	2.9 acres	Morgan Hill	Northwest of the US 101 and East Dunne Ave interchange	X		X	
Staging	3.9 acres	Morgan Hill	Southwest of the US 101 and East Dunne Ave interchange	X		X	
Staging	0.8 acre	Morgan Hill	Northwest of the US 101 and Tennant Ave intersection	X		X	
Staging	2.2 acres	San Martin	East of Caltrain/UPRR, south of the Railroad Ave and Maple Ave intersection		X		
Staging	7.1 acres	San Martin	Northeast of the East Middle Ave and Monterey Highway intersection		X		
Staging	3.6 acres	San Martin	East of Monterey Rd between East Middle Ave and Llagas Creek				X
Staging	4.2 acres	San Martin	East of UPRR				X
Staging	11.7 acres	San Martin	West of Monterey Hwy, at the California Ave and Colony Ave intersection		X		
Staging	2.7 acres	San Martin	West of Monterey Hwy and north of Roosevelt Ave		X		
Staging	26.2 acres	San Martin	South of South St		X		
Staging	3.9 acres	San Martin	North of Church Ave		X		
Precast	36.2 acres	Santa Clara County	East of Monterey Hwy and south of Buena Vista Ave	X			
Staging	21.5 acres	Santa Clara County	South of Church Ave			X	
Staging	1.5 acres	Santa Clara County	South of Masten St			X	
Precast	Two 10.8- and 27.1-acre sites	Santa Clara County	East of US 101, between Cohansey Ave and Las Animas Ave			X	

Type	Size	Jurisdiction	Location	Alternative			
				1	2	3	4
Staging	0.4 acre	Santa Clara County	South of Llagas Creek			X	
Staging	0.4 acre	Santa Clara County	South of Cohansey Ave		X		
Staging	1.5 acres	Santa Clara County	South of Las Animas Ave		X		
Staging	2.9 acres	San Benito	Lake Rd just south of 152			X	
Staging	8.8 acres	Gilroy	Northwest of the South Chestnut St and East Luchessa Ave intersection	X			
Staging	2.8 acres	Santa Clara County	Hollister Rd and Bloomfield Ave Intersection	X	X		
Staging	2.8 acres	San Benito County	West of Frazier Lake Rd	X	X		X
Staging	2.8 acres	San Benito County	West of Lake Rd	X	X		X
Staging	5.6 acres	San Benito County	Approx. 1.6 miles northwest of the Lovers Lane and Shore Rd intersection	X	X		
Staging	1.5 acres	San Benito County	West of Lovers Lane, approx. 0.6 mile south of the intersection with SR 152	X	X		X
Staging	2.8 acres	Santa Clara County	West of San Felipe Rd, approx. 0.7 mile south of its intersection with SR 152	X	X		X
Staging	2.8 acres	Santa Clara County	East of San Felipe Rd, approx. 0.7 mile south of its intersection with SR 152			X	
Staging/ Precast and batch plant	27.1 acres	Santa Clara County	Northeast of the San Felipe Rd and SR 152 intersection (Tunnel 1 west portal)	X	X	X	X
Staging	2.8 acres	Santa Clara County	Southeast of the San Felipe Rd and SR 152 intersection	X	X	X	X
Staging/ precast	14 acres	Santa Clara County	East of SR 152 and just south of Casa De Fruta Pkwy	X	X	X	X
Staging/ Precast	9.6 acres	Santa Clara County	West of SR 152 and Casa De Fruta Pkwy	X	X		X
Pacheco Pass Subsection							
Staging/Batch Plant/Precast	26.4 acres	Santa Clara County	South of SR 152, west of the tunnel portal	X	X	X	X
Staging/Batch Plant/Precast	15.0 acres	Merced County	East of tunnel portal, west of McCabe Rd	X	X	X	X
Staging	2.9 acres	Merced County	Fahey Rd	X	X	X	X

Type	Size	Jurisdiction	Location	Alternative 1	2	3	4
San Joaquin Valley Subsection							
Staging	36.7 acres	Merced County	West of Los Banos Creek	X	X	X	X
Staging	7.3 acres	Merced County	Northeast of the Henry Miller Rd and Mercey Springs Rd intersection	X	X	X	X
Staging	3.5 acres	Merced County	Southwest of Henry Miller Rd and Mercey Springs Rd intersection	X	X	X	X
Staging	1.1	Merced County	Midway Rd, south of Henry Miller Rd	X	X	X	X

Source: Authority 2019a
Approx. = approximately
Ave = Avenue
Blvd = Boulevard
Hwy = Highway
I = Interstate
Pkwy = Parkway
Rd = Road
SR = State Route
St = Street
UPRR = Union Pacific Railroad
US = U.S. Highway

The precasting yards required for Alternatives 1 and 3 would be located south of Communications Hill in San Jose, north of Morgan Hill, and north of Gilroy in unincorporated Santa Clara County. These precasting yards would encompass at least 35 acres to accommodate beam manufacturing and casting beds; concrete manufacturing through batch plants; storage of steel and beams; heavy equipment parking; administration buildings; employee parking; and access roads. Figure 2-69 shows a typical precasting yard layout, including estimated size requirements for each element.



MAY 2017

Figure 2-69 Typical Precasting Yard Layout

2.10.2.2 Non-Operational Right-of-Way

In certain negotiated right-of-way (ROW) purchase situations, the Authority may enter into agreements to acquire properties or portions of properties that are not directly needed for the construction of the HSR project and are not intended to be part of the operational ROW. These

are known as excess properties and are distinct from severed remnant parcels, which are evaluated as part of the project footprint. While eventually these properties would likely be sold as excess state property, these excess properties are not part of the project footprint and in the interim the Authority would need to conduct various management and maintenance activities on them (Authority 2018).

The process for acquisition and disposal of excess property is detailed in Chapter 16 of the California High Speed Rail Authority Right of Way Manual (ROW Manual) (January 2019). Chapter 11 of the ROW Manual identifies the following management and maintenance activities that may occur on any given excess property. The activities required on a given parcel will be dependent on site conditions including the presence of buildings or other structures, existing land uses, and habitat conditions.

Structure Demolition

Various structures may be present on excess property including single and multi-family residences, mobile homes, mobile offices, warehouses and other light industrial structures, sheds, fences, concrete driveways, signs, other non-descript buildings, and related appurtenances and utilities (in-ground pools, septic systems, water wells, gas lines, etc.) as well as orchards and ornamental shrubs and trees.

If the Authority determines that any existing uses of a particular structure are not going to continue, it may, following additional environmental review if/as necessary (for example, to confirm the structure is not considered historic), decide to demolish and remove the structure. Demolition of a structure may also be appropriate if the structure is in a state of disrepair or a potential safety and security concern exists from trespassers.

The properties may include utilities such as water wells, septic systems, gas, and electric lines that would require removal in accordance with local and State regulations. Local construction permits for demolition and removal would be secured from the local agency with jurisdiction (e.g. well demo permit, septic removal, etc.).

Vegetation Management

Excess properties may have a variety of vegetation present including ornamental landscaping, various crops including orchards or vineyards, and natural habitats such as annual grassland. Vegetation management may occur as part of initial site clearing efforts or as part of ongoing management.

Initial site clearing is likely to occur in conjunction with structure demolition. Ornamental landscaping may be removed to reduce ongoing maintenance needs. Vegetation removal or disturbance may be necessary for equipment access during structure demolition. If certain agricultural crops are present on site, particularly orchards or vineyards, they may be removed if the Authority determines that it is appropriate based on the condition of the plants.

Ongoing vegetation management activities may include mowing, discing, or similar mechanical control, the clearing of firebreaks on larger properties, and, if noxious weeds are present, they may be treated with the use of approved herbicides. Mowing or other mechanical control may be used to maintain vegetation at a certain height or density based on site specific concerns of security, visual appearance or fire prevention. The mechanical control of weed species may also be appropriate depending on the relevant species and site conditions. Firebreaks may be mowed or disced in an approximately 12-foot band around the exterior of a site. Internal fire breaks may be appropriate for larger sites. All herbicide application will be conducted in a manner consistent with product labeling and applicable laws including application by a licensed Pest Control Advisor if appropriate.

Pest Management

Pest management may include the mechanical control of insects, rodents and other animals. Mechanical removal (trapping) of rodents and other animals may be appropriate in or around structures that exist on excess properties. Mechanical removal of animals will be conducted by a

licensed Pest Control Advisor and after obtaining any appropriate local approvals. Rodenticide will not be used for the control of animals.

Chemical control of insects may occur in or around buildings on excess property or in agricultural areas to control pest species. Any pesticide application will be conducted in a manner consistent with product labeling and applicable laws including application by a licensed Pest Control Advisor if appropriate and after obtaining any appropriate local approvals.

Site Security

Site Security will primarily consist of the installation of fencing around properties. The installation of fencing may be appropriate on properties where structures will remain or where there is a safety and security concern or particular risk of trespass. Fencing will consist of 6-12 -foot high chain-link fencing and may include barb wire or similar features at the top. Fence posts may be either metal or wood and require an excavation up to four inches in diameter and three feet deep. Other security devices such as security lighting, an alarm system or cameras may be implemented if specific conditions require it. If buildings or other structures are present on the site, windows and doors may be boarded up to prevent trespass. “No Trespassing” or similar signs may be posted as appropriate.

Site security will also involve the periodic inspection of excess properties for signs of trespass and the removal of any accumulated trash or dumping.

Structure Maintenance

If buildings or other structures remain onsite, they will be maintained in a clean and orderly condition so as not to detract from the general appearance of the neighborhood. If the property is rented or leased, maintenance activities will be undertaken as needed to ensure the health and safety of occupants. Maintenance and repair activities may include exterior and interior painting, yard maintenance, repair or replacement of plumbing, electrical facilities, roofs, windows, heaters, and built-in appliances and other similar activities.

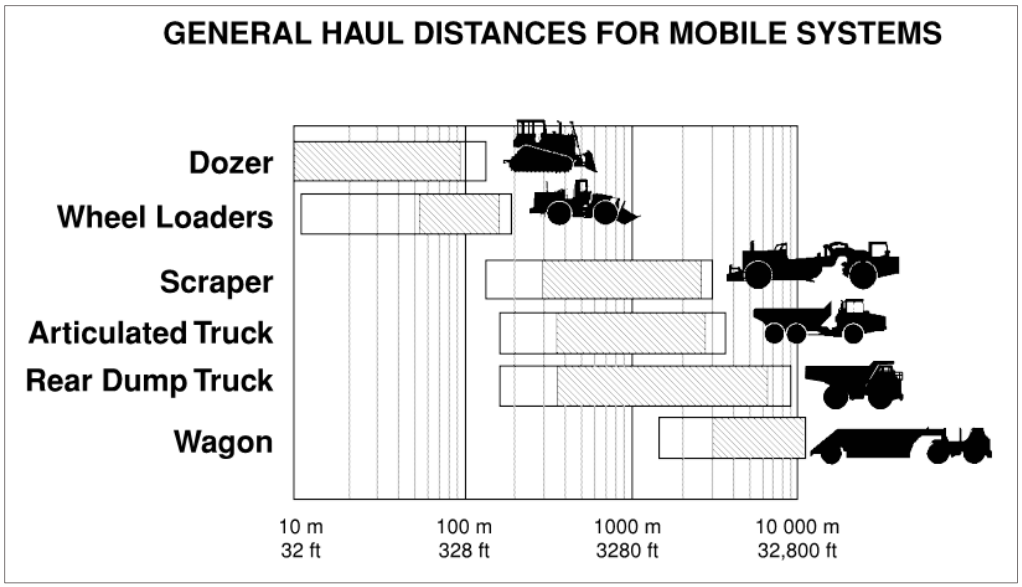
2.10.3 Major Construction Activities

Major types of construction activities for the project include earthwork; bridge, aerial structure, and roadway crossings; railroad systems; and station construction, as briefly described in the following subsections.

2.10.3.1 Earthwork

Earthwork is a general term applied to the movement or removal of soils by mechanical equipment (excavation) and the placement and compaction of soils by mechanical equipment (embankment). Earthwork would be conducted using conventional earthmoving methods and heavy construction equipment, such as dozers, wheel loaders, scrapers, articulated trucks, rear dump trucks, and wagons. The type of equipment used would depend on the hauling distance, with trucks or wagons used for longer distances. Figure 2-70 shows the general haul distances and equipment type.

The HSR system seeks to balance the volume of soils needed for excavation and embankment and to minimize the input of materials from quarries and disposal of materials outside the right-of-way. This earthwork balance assumes that excavated soils would be suitable for use as embankment fill (Appendix 2-L). The Authority and its contractors are conducting geotechnical investigations within the HSR project footprint to assess the geotechnical properties of existing soils, evaluate opportunities for soil re-use, and determine improvements to make existing soils suitable for HSR re-use.



MAY 2017

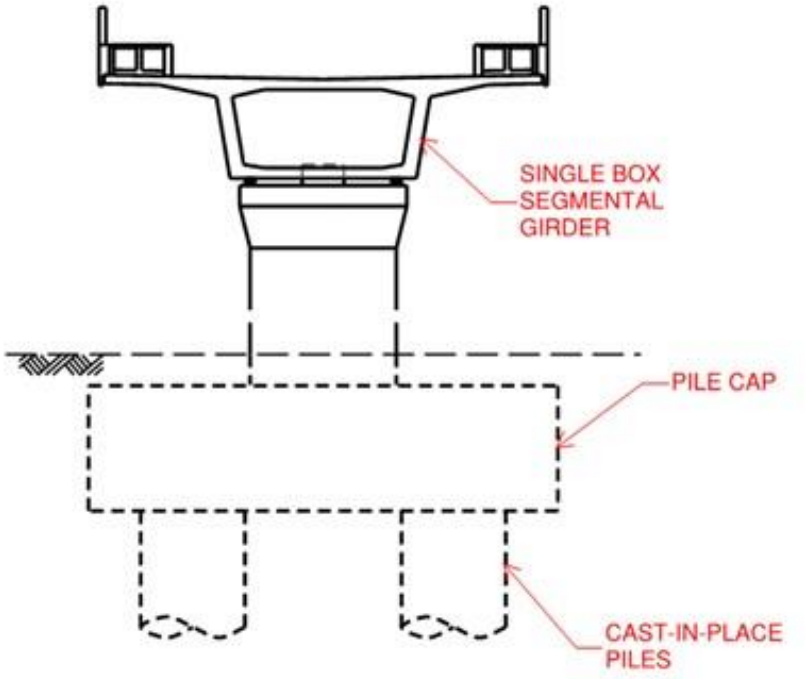
Figure 2-70 Expected Haul Distances by Equipment Type

The project would require greater quantities of embankment than excavation for Alternatives 2 and 4, requiring approximately an additional 2.3 million and 900,000 cubic yards of ballast and subballast material, respectively. Ballast and subballast materials may be imported from off-site quarries. To minimize material transport, the preliminary engineering design has identified construction staging sites (Table 2-17) that would store excavated materials close to where they would be placed, minimizing repeated handling of materials.

All four project alternatives would require earthwork construction. Alternatives 2 and 4 would require construction of 53 to 59 miles of embankment or trench, while Alternatives 1 and 3 would require 29 miles of embankment or trench construction. The greater amount of earthwork under Alternatives 2 and 4 is primarily a result of the embankment and at-grade profile through the Morgan Hill and Gilroy Subsection.

2.10.3.2 Bridge, Aerial Structure, and Roadway Crossing Construction

As is done for existing HSR systems around the world, most of the elevated guideways would be designed and built using single box segmental girder construction. Where needed, other structural types and construction methods would be considered. This section provides an overview of the construction methods required for foundations, substructures, and superstructures of bridges, aerial structures, and roadway crossings. Figure 2-71 illustrates the typical components of aerial structures.



MAY 2017

Figure 2-71 Typical Aerial Structure Components

Foundations

A typical aerial structure foundation pile cap is supported by an average of four large-diameter (5 to 9 feet) bored piles. Depth of piles depends on the geotechnical conditions at each pile site. Pile construction can be achieved by using rotary drilling rigs, and either bentonite slurry or temporary casings may be used to stabilize pile shaft excavation. The estimated pile production rate is 4 days per pile installation. Additional pile installation methods available to the contractor include bored piles, rotary drilling CIP piles, driven piles, and a combination of pile jetting and driving.

Following completion of the piles, pile caps can be constructed using conventional methods supported by structural steel: either precast and pre-stressed piles or cast-in-drilled-hole piles. For pile caps constructed near existing structures such as railways, bridges, and underground drainage culverts, temporary sheet piling (i.e., temporary walls) can be used to minimize disturbances to adjacent structures. Sheet piling installation and extraction would likely be achieved using hydraulic sheet piling machines.

Substructure

Typical aerial structures of up to 90 feet would be constructed using CIP bent caps and columns supported by structural steel and installed upon pile caps. A self-climbing formwork system may be used to construct piers and portal beams more than 90 feet high. The self-climbing formwork system is equipped with a winched lifting device, which is raised up along the column by hydraulic means with a structural frame mounted on top of the previous pour. In general, a 3-day cycle for each 12-foot pour height can be achieved. The final size and spacing of the piers depend on the type of superstructure and spans they are supporting.

Superstructure

The selection of superstructure type would consider the loadings, stresses, and deflections encountered during the various intermediate construction stages, including changes in static scheme, sequence of tendon installation, maturity of concrete at loading, and load effects from erection equipment. Accordingly, the final design would depend on the contractor's selected means and methods of construction, such as full-span precast, span-by-span, balanced cantilever segmental precast, and CIP construction on falsework. These superstructure construction methods are described in full detail in Appendix 2-L and are summarized as follows:

- **Full-span precast construction**—Box girders would be precast and prestressed in advance as full spans and stored in a precasting yard. The 110-foot precast segments, weighing around 900 tons, would be transported along the previously constructed aerial guideway using a special gantry system (Figure 2-72). This method is anticipated to be used for approximately 95 percent of the construction in the Monterey Corridor and Morgan Hill and Gilroy Subsections under Alternatives 1 and 3.
- **Span-by-span precast segmental construction**—Shorter box girder segments would be precast and prestressed and stored in a precasting yard. These segments, limited to 12-foot segments weighing less than 70 tons, would likely be individually transported to the construction site by ground transportation. Once the gantry system is in place, construction would involve hoisting the segments from the ground and installing and tensioning the prestressing tendons to create the box girder (Figure 2-73).
- **Balanced cantilever segmental construction**—In locations where construction would occur over existing facilities that prevent equipment and temporary supports on the ground, balanced cantilever segmental construction may be used. Under this construction method, box girder segments (12-foot segments weighing less than 70 tons) that are either precast or CIP would be placed in a symmetrical fashion around a bent column. The segments would be anchored at the ends by cantilever tendons located in the deck slab, with midspan tendons balancing the weight between two cantilevers (Figure 2-74). Precast segments would be precast off site, transported to the construction site, and installed incrementally onto a portion of the existing cantilever using ground cranes, hoisting devices, or a self-launching gantry. Segments can also be CIP and installed two at a time, one at each end of the balanced cantilever. Segments generated by CIP are generally longer than those in precast construction since they do not need to be transported to the construction site.
- **Cast-in-place construction on falsework**—The method involves creating a suspended formwork with either a launching girder or gantry system. Once the formwork is in position and reinforcements and prestressing are placed, concrete is poured and the prestressing is stressed. The formwork is then removed and moved to the next segment (Figure 2-75).

Construction of road crossings and bridges would be similar to the approaches described for aerial structures. The superstructure would likely be constructed using precast, prestressed, concrete girders and CIP deck. Approaches to bridges would be earthwork embankments, mechanically stabilized earth wall, or other retaining structures.

Figure 2-72 Full-Span Precast Construction on Taiwan HSR

Figure 2-73 Span-by-Span Precast Segmental Construction

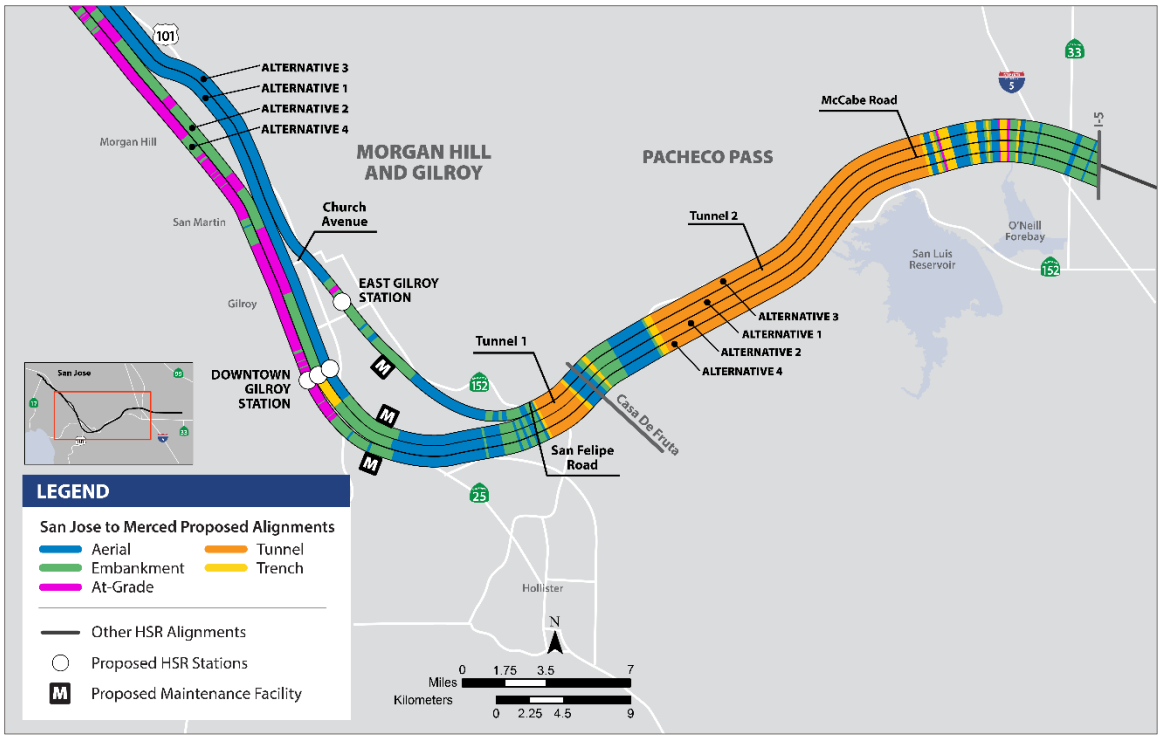
Figure 2-74 Balanced Cantilever Segmental Construction

Figure 2-75 Cast-in-Place Construction on Formwork

Crossings of existing railroads, roads, and the HSR would be constructed on the line of the existing road or offline at some locations. When constructed online, the existing road would be closed or temporarily diverted. When constructed offline, the existing road would be maintained in use until the new crossing is completed. Single tracking of VTA service would be necessary during construction of the SR 87 bridge under Alternative 4. The following project features are necessary for VTA to modify operations during construction: a new crossover with two powered switches south of Tamien Station, provision of power to six existing switches, and installation of track signals at these new and existing powered switches. Where HSR would cross over existing railroads, the Authority would coordinate with the rail operators to avoid operational impacts during construction. Under all four alternatives, where new roadway undercrossings of existing railroads are required, a temporary shoofly track would be constructed to maintain railroad operations during undercrossing construction.

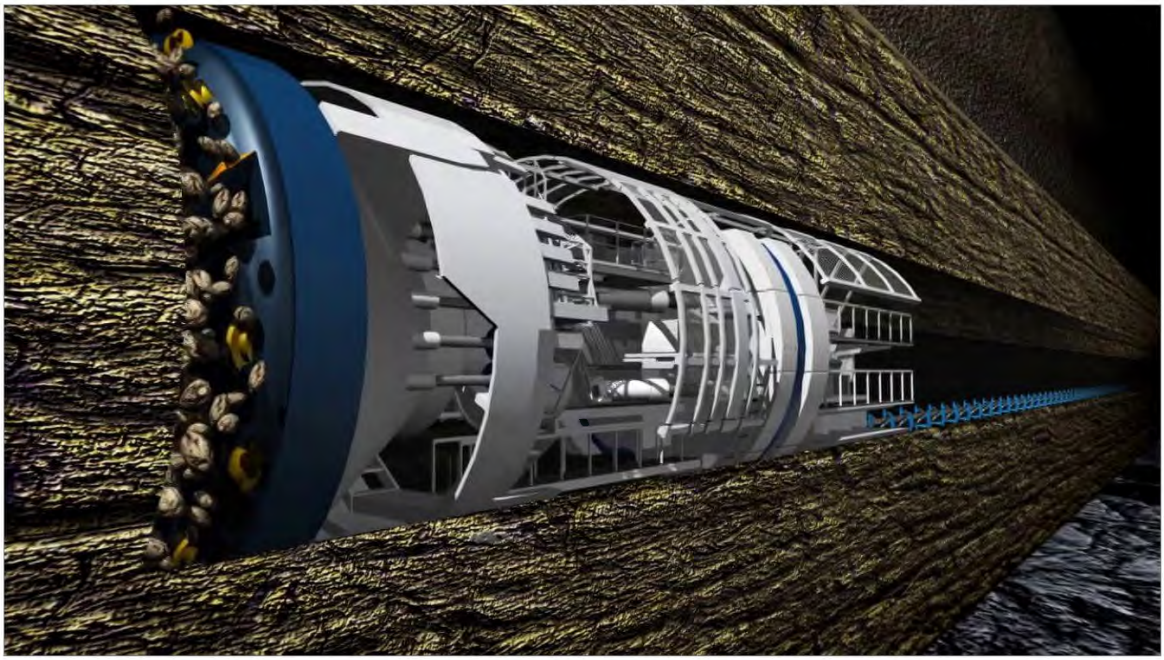
2.10.3.3 Tunnels

Tunnels would be used where the HSR system passes through a hill or mountain where the vertical profile is too deep to use an open cut to pass through the topography. The project would require the construction of two tunnels—Tunnel 1 in the Morgan Hill and Gilroy Subsection and Tunnel 2 in the Pacheco Pass Subsection. Figure 2-76 illustrates the two tunnel locations for the project. Figure 2-77 illustrates a typical TBM. Figure 2-78 shows two TBMs at a twin-bore tunnel. Figure 2-77 and Figure 2-78 are representative of what is anticipated for the project tunnels. These would be twin-bore, single-track tunnels, with lengths of approximately 1.6 and 13.5 miles, respectively, and a minimum internal diameter of 29.5 feet. Localized enlargements, or niches, may be required at intervals to accommodate equipment such as OCS tensioning devices, traction power paralleling stations, ventilation fans, communication equipment, signaling equipment, and drainage systems. Cross passages, placed no more than 800 feet apart, would be required between adjacent tunnels to provide emergency exits. The Authority would acquire exclusive underground property approximately 132 feet wide and 62 feet high to accommodate both tunnels and all support elements.



Source: Authority 2019a JUNE 2019

Figure 2-76 Locations of Tunnels along the Alternatives



DECEMBER 2017

Figure 2-77 Tunnel Boring Machine

JANUARY 2018

Figure 2-78 Tunnel Boring Machines at Double Portal Entrance

Preparation for and construction of these tunnels would occur over a 6-year period, and would generally proceed as follows:

- **Construction of access roads to the future tunnel portal sites**—A new access road would be constructed on the west side of SR 152 from Walnut Avenue to the east portal of Tunnel 1, and a new road and bridge across Pacheco Creek would be constructed to the west portal of Tunnel 2. McCabe Road would be improved to provide access to the east portal of Tunnel 2.
- **Construction of power system**—Overhead power lines would be installed to the construction staging areas, and portable diesel generators would be installed to provide backup power supply.
- **Preparation of tunnel portals**—A large, level area would be constructed at each tunnel portal, including installation of retaining walls to minimize grading and slope modification. At the portals for Tunnel 2, this construction would likely include hillside slope reduction or application of drainage techniques, as well as ongoing monitoring and maintenance, to reduce the potential for landslides. Tunnel portals would initially be used to store precast materials and equipment, assemble and maintain equipment, stockpile tunnel spoils, and conduct ongoing monitoring and measuring of safety and ventilation systems. Portals would also be designed to accommodate housing trailers, ventilation buildings, communications equipment, power facilities, water and sewage, lighting and fencing, and clear areas for parking and storage.[18]
- **Manufacturing and transport of precast tunnel support materials**—Precast materials, such as the tunnel lining segments, would be manufactured off site and transported to the tunnel portals.

Tunnel excavation would likely be conducted using a combination of TBMs and conventional tunneling methods at either end of the tunnel portals. The type of machine used would be determined by the Authority's design-build contractor, based on the tunnel length, the particular geology of the project, the amount and characteristics of groundwater present, and other factors. A detailed discussion of tunnel construction methods is available in the *San Jose to Merced Project Section Conceptual Tunnel Design and Constructability Considerations—Pacheco Pass* (Authority 2017b) and is summarized below:

- **Conventional tunneling methods**—The primary conventional tunneling method anticipated to be used is a roadheader, consisting of a boom-mounted cutting head, a loading device usually involving a conveyor, and a crawler traveling track to move the machine forward into the rock face. Drill-and-blast techniques and the use of hydraulic excavators could also be required. For conventional tunneling methods, the estimated power demand is 3,000 kilovolt-amperes (kVA) to operate two roadheaders, two drill jumbos, and ancillary equipment, with 1,000 kVA emergency power supply.
- **Tunnel boring machines**—TBMs are shielded or open-type machines consisting of a rotating cutting wheel, called a cutterhead, followed by a main bearing, a thrust system, and trailing support mechanisms. Support mechanisms can include conveyors or other systems for muck removal, control rooms, electrical systems, dust removal, ventilation, and mechanisms for transport of precast segments. These machines excavate rock with disc cutters mounted in the cutterhead, and then transfer the excavated rock through openings in the cutterhead to a belt conveyor for removal from the tunnel. Following TBM excavation, a tunnel lining is built with steel ribs and lagging or precast concrete segments. The shield is then pushed forward with hydraulic jacks that thrust against the installed lining and the back of the tunnel shield. For TBM excavation, the estimated power demand for a single construction staging area of a twin-bore tunnel is 7,500 kVA to power two TBMs, trailing gear,

[18] Reinforced structures may be necessary for permanent support at tunnel portals. Permanent structures would be designed for the most unfavorable load combinations. Depending on the various conditions, including slope stability, static earth pressures, and seismic loading, slope stability mitigation measures may be required.

continuous conveyors, ventilation fans, lights, pumps, shop equipment, change house, yard lighting, and office trailers, as well as 4,000 kVA for an emergency power supply.

- **Transport of tunnel spoils**—Tunnel excavation would generate large volumes of soil and rock materials (an estimated 0.5 million cubic yards from Tunnel 1 and 4.3 million cubic yards from Tunnel 2). Tunnel spoils would be temporarily stockpiled at the tunnel portal and, depending on geotechnical properties, distributed along the alignment and reused for embankment fill or nonstructural fill. Depending on the rate of excavation, the transport of tunnel spoils could require approximately 160 3-axle dump truck trips per day at each tunnel portal (Appendix 2-L).

2.10.3.4 Railroad Systems Construction

The HSR system would include trackwork, traction power electrification, signaling, and communications. After completion of earthwork and structures, trackwork is the first rail system to be constructed, and it must be in place at least locally to start traction power electrification and railroad signalizing installation. Trackwork construction generally requires the welding of transportable lengths of steel running onto longer lengths (approximately 0.25 mile), which are placed in position on crossties or track slabs and field-welded into continuous lengths.

Tie-and-ballast and slab track construction would be used. Tie-and-ballast construction, which would be used for at-grade profiles and minor structures, typically uses crossties and ballast that are distributed along the track bed by truck or tractor. In sensitive areas, such as where the HSR is parallel to or near streams, rivers, or wetlands, and in areas of limited accessibility, this operation may be accomplished by using the constructed rail line for material delivery. For major civil structures, slab track construction would be used. Slab track construction is a nonballasted track form using precast supports to which the track is directly fixed.

Traction power electrification equipment to be installed includes TPSSs, traction power switching and paralleling stations, and the OCS. Traction power facility equipment and houses are typically fabricated and tested in a factory, then delivered by tractor-trailer to a prepared site adjacent to the alignment. TPSSs are assumed to be located every 30 miles along the alignment. Traction power switching stations are located every 15 miles and traction power paralleling stations every 5 miles along the alignment. The OCS is assembled in place over each track and includes poles, brackets, insulators, conductors, and other hardware.

Signaling equipment to be installed includes wayside cabinets and bungalows, communications radio towers, wayside signals (at track interlockings[19]), switch machines, insulated joints, impedance bonds, and connecting cables. The equipment will support automatic train protection; enhanced automatic train protection; and PTC to maintain train separation, routing at interlocking, and speed.

2.10.3.5 Station Construction

Because the HSR stations in San Jose and downtown Gilroy would be co-located with existing Caltrain stations, existing train operations would be maintained during HSR station construction/modification. The San Jose Diridon Station and Downtown Gilroy Station would be reconstructed to accommodate the HSR system, while the East Gilroy Station would be a new station. HSR stations require significant coordination and planning to accommodate safe and convenient access to existing businesses and residences, to complement transit-oriented and station-supportive development, and to accommodate traffic control during construction periods. Additional information about the station areas is provided in Section 2.6.2. The typical construction sequence at station areas would be as follows:

- **Demolition and site preparation**—The contractor would be required to construct detour roadways, new station entrances, construction fences and barriers, and other elements to

[19] *Interlockings* are signaling equipment that control safe train movement and prevent conflicting movements at junctions or crossings.

replace the removal from service of existing facilities on the worksite. The contractor would be required to perform street improvement work, site clearing and earthwork, drainage work, and utility relocations. Additionally, electrical substations and maintenance facilities are assumed to be newly constructed structures. For platform improvements or additional platform construction, the contractor may be required to realign existing track.

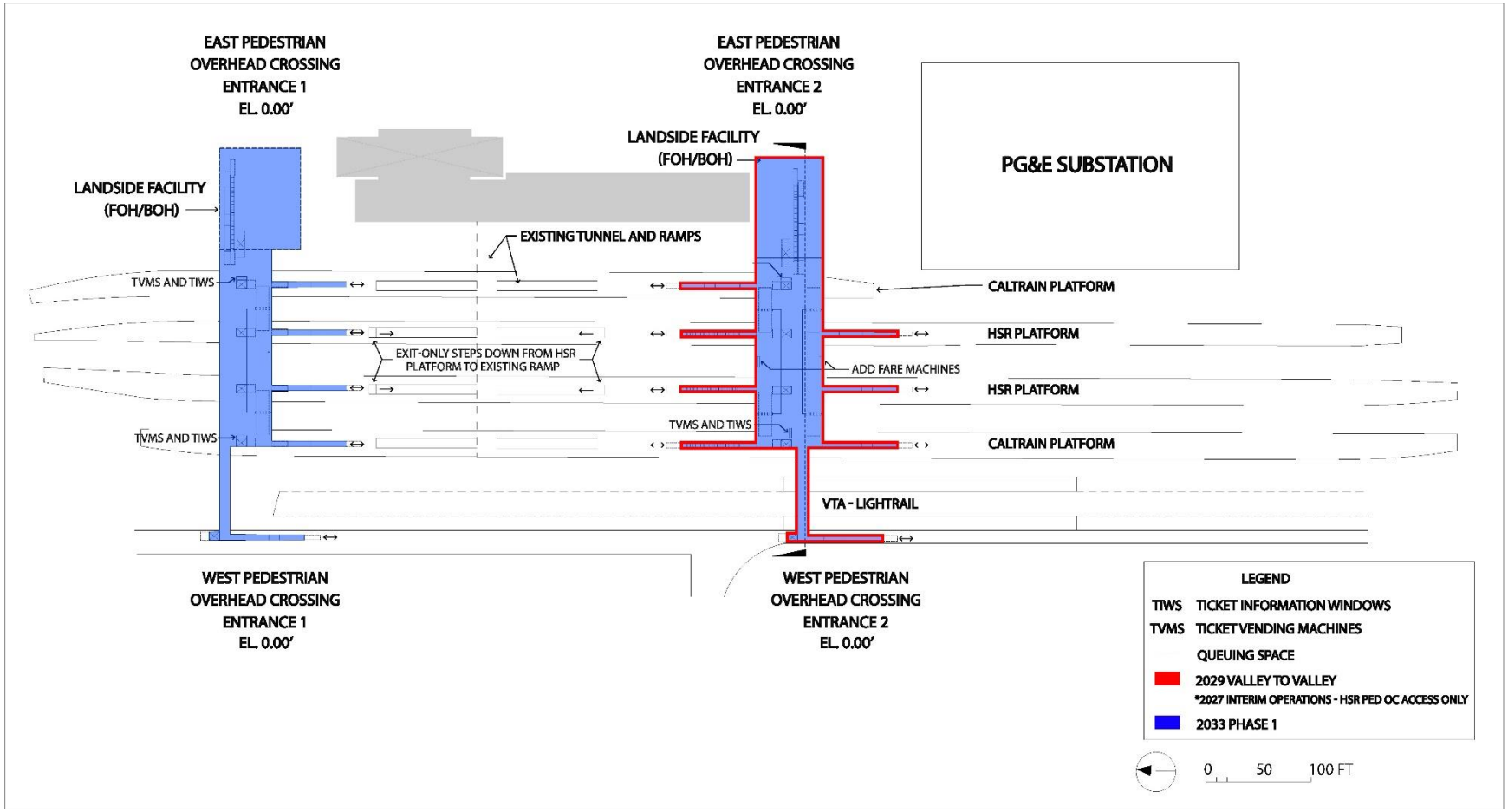
- **Structural shell and mechanical/electrical rough-ins**—For these activities, the contractor would construct foundations and erect the structural frame for the new station, enclose the new building, construct new platforms, and connect the structure to site utilities. Additionally, the contractor would rough-in electrical and mechanical systems and install specialty items such as elevators, escalators, and ticketing equipment.
- **Finishes and tenant improvements**—The contractor would install electrical and mechanical equipment, communications and security equipment, finishes, and signage. Additionally, the contractor may install other tenant improvements if requested.

San Jose Diridon Station

Under Alternatives 1, 2, and 3, the project would involve modification of the existing San Jose Diridon Station—existing platforms would be rebuilt, and the vertical circulation would be modified and replaced. Modifying the station would take place in six stages, with one of the station tracks and platforms closed for each stage. The first stage would temporarily close the easternmost Caltrain tracks and platforms to construct the HSR viaduct piers and reconstruct the platforms. When this work is complete, the easternmost tracks and areas would recommence operation. The second stage would temporarily close the next set of track and platform, and so on through five stages. The sixth stage would construct the station house. After completing the five stages of HSR viaduct supports and during construction of the HSR concourse and platforms, all Caltrain tracks and platforms would be operational.

Under Alternative 4, the project would primarily involve installing new turnouts and modifying the configuration of San Jose Diridon Station to build two aerial 1,400-foot platforms for HSR, retain two platforms for commuter and conventional intercity trains, provide passenger services and train operations support in new structures north and south of the existing station building, build new overhead concourses for passenger access to train platforms, and relocate the existing bus station in three stages to accommodate progressive growth in HSR services (Figure 2-79):

- San Francisco to Gilroy Early Service in 2027 would require all passenger platform improvements, HSR passenger and operations support in a building south of the existing station house, and an overhead concourse from the south HSR station building with ramps to the two HSR platforms. Access to existing subway ramps would be retained for HSR passenger egress.
- Valley-to-Valley Service in 2029 would require ramps from the south overhead concourse to the Caltrain platforms.
- Phase 1 Service in 2033 would require development of another HSR building north of the existing station house, relocation of the existing bus station at that location, a second overhead pedestrian concourse from the north HSR station building with ramps to all train platforms, and closure of all platform ramps down to the subway.


EAST PEDESTRIAN OVERHEAD CROSSING ENTRANCE 1 EL. 0.00'
EAST PEDESTRIAN OVERHEAD CROSSING ENTRANCE 2 EL. 0.00'
LANDSIDE FACILITY (FOH/BOH)
LANDSIDE FACILITY (FOH/BOH)
PG&E SUBSTATION
EXISTING TUNNEL AND RAMPS
TVMS AND TIWS
CALTRAIN PLATFORM
HSR PLATFORM
EXIT-ONLY STEPS DOWN FROM HSR PLATFORM TO EXISTING RAMP
ADD FARE MACHINES
HSR PLATFORM
TVMS AND TIWS
TVMS AND TIWS
CALTRAIN PLATFORM
VTA - LIGHTRAIL
WEST PEDESTRIAN OVERHEAD CROSSING ENTRANCE 1 EL. 0.00'
WEST PEDESTRIAN OVERHEAD CROSSING ENTRANCE 2 EL. 0.00'
LEGEND
TIWS TICKET INFORMATION WINDOWS
TVMS TICKET VENDING MACHINES
QUEUING SPACE
2029 VALLEY TO VALLEY
*2027 INTERIM OPERATIONS - HSR PED OC ACCESS ONLY
2033 PHASE 1
0 50 100 FT

MARCH 2019

Figure 2-79 Phasing of San Jose Diridon Station for Alternative 4

Downtown Gilroy Station

A Downtown Gilroy Station would be constructed under Alternatives 1, 2, and 4. Under Alternative 1, the HSR station would be co-located and constructed around the existing Gilroy Caltrain Station. A pedestrian undercrossing would connect the new station entrances on either side of the track, and Caltrain service would not be interrupted for construction of the undercrossing. Track realignment work would, however, temporarily relocate the existing Caltrain platform. Under Alternative 2, the existing station platforms would be rebuilt. UPRR, Caltrain, and HSR tracks would be located on the same elevated structure, and Caltrain service would be disrupted during track realignment and station construction. During work on the Caltrain and UPRR facilities, temporary tracks and platforms would be located at the future HSR platform locations as a shoofly.

Under Alternative 4, the existing station platforms would be repurposed for longer HSR platforms with tracks on the inside and two shorter platforms on the outside for Caltrain, Amtrak, and TAMC. A new overhead concourse would provide passenger access to all platforms.

East Gilroy Station

An East Gilroy Station would be constructed under Alternative 3. This would be a new station. The proposed site would require limited work within the constraints of existing buildings or infrastructure. As there is no existing train service in this area, construction of this station would not affect existing train service. The nearest train service is in downtown Gilroy, west of US 101.

Other Stations Affected by HSR Construction

Construction of the alternative alignments would affect the following existing Caltrain stations: Santa Clara Station, College Park Station, Capitol Station, Tamien Station, Blossom Hill Station, Morgan Hill Station, and San Martin Station. Construction work at these stations would be coordinated with the affected transit service providers to maintain access to and operation of existing facilities or to provide temporary facilities to support continued operation during construction. Construction could entail shifting the position of the platforms or access, changing platform types, providing grade-separated pedestrian access to platforms, maintaining parking capacity, and other methods to maintain operations.

2.11 Permits

The Authority has entered into agreements with environmental resource agencies to facilitate the issuance of environmental authorizations required prior to construction. These agreements are intended, in part, to identify the Authority's responsibilities in meeting the requirements of these federal and state regulatory processes.

A memorandum of understanding (MOU) was established in 2010 between the FRA, Authority, USACE, and USEPA (FRA et al. 2010) regarding integration of NEPA, Clean Water Act Section 404, and Rivers and Harbors Act Section 14 ("Section 408") processes. In addition, the Authority and FRA entered into a Section 106 Programmatic Agreement with the California State Historic Preservation Officer in 2011 to establish the process for considering effects on historic properties during project-level environmental reviews. An MOU was established between the Authority and the State Water Resources Control Board (SWRCB) regarding items that would require a Complete Application for Clean Water Act Section 401 Certification and/or Waste Discharge Requirements, the delineation of nonfederal wetlands and other waters of the state that are not waters of the U.S., and any future amendments to the existing SWRCB requirements regarding applications and delineation methods.

Table 2-18 shows the major environmental reviews, permits, and approvals required for the project. The table identifies each agency's status as a NEPA cooperating agency or CEQA responsible agency. As a state agency, the Authority is exempt from local permit requirements; however, in order to coordinate construction activities with local jurisdictions, the Authority plans to pursue local permits as part of construction processes consistent with local ordinances. These local permits may include, but are not limited to, major encroachment permits, grading and drainage permits, and major improvement permits. The agencies identified in the table are anticipated to rely on the EIR/EIS documents to support their permitting and approval processes. Other approvals may require new specific documentation.

Table 2-18 Anticipated Environmental Reviews, Permits, and Approvals

Agency	Permit
Federal	
U.S. Army Corps of Engineers (NEPA cooperating agency)	▪ Section 404 Permit for discharge of dredge or fill materials into waters of the U.S., including wetlands, under the Clean Water Act of 1972 ▪ Section 14 of the Rivers and Harbors Act of 1899 (Section 408) permission to alter or modify a facility or feature of any federal project levee or federally regulated flood control system
U.S. Department of the Interior, Bureau of Reclamation (NEPA cooperating agency)	▪ Encroachment permit ▪ Use permit
U.S. Department of Transportation/Federal Railroad Administration	▪ Section 4(f) of the U.S. Transportation Act of 1966
U.S. Department of Interior/National Park Service	▪ Section 6(f) of the Land and Water Conservation Fund Act of 1965
U.S. Advisory Council on Historic Preservation and the California State Historic Preservation Office	▪ Section 106 consultation (National Historic Preservation Act of 1966) and memorandum of agreement
U.S. Environmental Protection Agency (NEPA cooperating agency)	▪ Review of environmental impact statement under Clean Air Act Section 309 ▪ Review of environmental justice conclusions ▪ General Conformity Determination
U.S. Fish and Wildlife Service	▪ Section 7 consultation and biological opinion/incidental take statement pursuant to the Endangered Species Act of 1973
National Oceanic and Atmospheric Administration, National Marine Fisheries Service	▪ Section 7 consultation and biological opinion/incidental take statement pursuant to the Endangered Species Act of 1973
Surface Transportation Board (NEPA cooperating agency)	▪ Authority to construct and operate new rail line

Agency	Permit
Federal Emergency Management Agency	▪ Conditional Letter of Map Revision (CLOMR) ▪ Letter or Map Revision (LOMR) ▪ No-Rise Certification for floodways
U.S. Department of Agriculture, Natural Resources Conservation Service	▪ Watershed and Flood Prevention Operations Program review for modifications to levees along Llagas Creek (Alternative 3 only) and West Branch Llagas Creek (Alternatives 1, 2, and 4).
State	
California Department of Fish and Wildlife (CEQA responsible agency)	▪ Incidental take permit under Section 2081 of the California Fish and Game Code ▪ California Fish and Game Code Section 1600 et seq. lake and streambed alteration agreement
California Department of Transportation (Caltrans) (CEQA responsible agency)	▪ Caltrans encroachment permits ▪ Joint use agreements ▪ Transfers of jurisdiction
California Public Utilities Commission (CEQA responsible agency)	▪ Approval for construction and operation of railroad crossings of public road and ministerial Notice of Construction or discretionary Permit to Construct associated with network upgrades to PG&E facilities.
California State Historic Preservation Office	▪ Section 106 consultation (National Historic Preservation Act of 1966)
California State Lands Commission (CEQA responsible agency)	▪ Lease for crossing state sovereign lands
State Water Resources Control Board Central Valley Water Quality Control Board San Francisco Bay Regional Water Quality Control Board (CEQA responsible agencies)	▪ Section 401 Water Quality Certification under the Clean Water Act of 1972 ▪ Construction General Permit (Order No. Order 2009-0009-DWQ) ▪ Industrial General Permit (Order No. 2014-0057-DWQ) ▪ Caltrans Statewide MS4 Permit (Order No. 2012-0011-DWQ) ▪ Phase I Municipal Separate Storm Sewer System (MS4)/Municipal Regional Permit (Order No. R2-2015-0049) ▪ Phase II MS4 Permit (Order No. 2013-0001-DWQ) ▪ VOC and Fuel General Permit (Order No. R2-2012-0012) ▪ Groundwater General Permit (Order No. R2-2012-0060) ▪ Discharges with Low Threat to Water Quality (Order No. R3-2011-0223) ▪ Dewatering and Other Low Threat Discharges (Order No. R5-2013-0074) ▪ Spill prevention, control, and countermeasure (SPCC) plan (part of Section 402 process) ▪ Stormwater construction and operation permit
California Department of Water Resources (CEQA responsible agency)	▪ Encroachment permit

Agency	Permit
Regional	
San Joaquin Valley Air Pollution Control District (CEQA responsible agency)	▪ Rule 201 General Permit Requirements, Rule 403 Fugitive Dust, Rule 442 Architectural Coatings, Rule 902 Asbestos, and Rule 9510 Indirect Source Review
Bay Area Air Quality Management District (CEQA Responsible Agency)	▪ Rule 201 General Permit Requirements, Rule 403 Fugitive Dust, Rule 442 Architectural Coatings, Rule 902 Asbestos, and Rule 9510 Indirect Source Review
Monterey Bay Air Resources District (CEQA Responsible Agency)	▪ Rule 201 General Permit Requirements, Rule 403 Fugitive Dust, Rule 442 Architectural Coatings, Rule 902 Asbestos, and Rule 9510 Indirect Source Review

CEQA = California Environmental Quality Act
NEPA = National Environmental Policy Act

3 AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES, AND MITIGATION MEASURES

3.1 Introduction

Since publication of the Draft Environmental Impact Report (EIR)/Environmental Impact Statement (EIS), the following substantive changes have been made to this section:

- A footnote was added to Section 3.1.1, Federal and State Regulatory Context, regarding the updated FRA Environmental Procedures and Council on Environmental Quality (CEQ) regulations issued after release of the Draft EIR/EIS.
- Section 3.1.3, Changes between the Draft EIR/EIS and this Final EIR/EIS, was added.
- Section 3.1.4, Chapter 3 Purpose, was updated to include the Diridon design variant (DDV) and the tunnel design variant (TDV), which were included in Section 3.20 in the Draft EIR/EIS but have now been incorporated as appropriate into the resource topic sections of Chapter 3 of the Final EIR/EIS.
- Section 3.1.6.6, Environmental Consequences, was updated to reference ridership forecasts for 2040 from the 2020 Business Plan (Authority 2021).
- Where appropriate, the verb “would,” when used specifically to describe impact avoidance and minimization features (IAMFs) or mitigation measures, as well as their directly related activities, was changed to “will,” indicating their integration into project design.

3.1.1 Federal and State Regulatory Context

Chapter 3, Affected Environment, Environmental Consequences, and Mitigation Measures, addresses existing environmental conditions and the potential impacts of the California High-Speed Rail (HSR) San Jose to Central Valley Wye Project Extent (project or project extent) on environmental resources. This chapter examines each resource in a separate subsection. Section 3.1 describes the federal and state requirements to address potential environmental impacts, the purpose of this chapter, the environmental resources considered, and the organization and content of each resource subsection.

The California High-Speed Rail Authority (Authority) is preparing this Final EIR/EIS pursuant to the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA). The CEQA Guidelines (14 California Code of Regulations § 15000 et seq.) encourage the preparation of joint NEPA/CEQA documents and the use of an EIS to satisfy CEQA requirements, where possible and appropriate. The Authority has used its best judgment in preparing this combined EIR/EIS to satisfy both NEPA and CEQA requirements.

NEPA requires federal agencies to consider the potential environmental impacts in the evaluation of any proposed federal agency action. NEPA also obligates federal agencies to consider the environmental consequences and costs of their projects and programs as part of the planning process. Pursuant to the NEPA Assignment Memorandum of Understanding, the Authority has assumed the Federal Railroad Administration’s (FRA) obligations under NEPA and has prepared this Final EIR/EIS in compliance with CEQ regulations (40 Code of Federal Regulations [C.F.R.]

Parts 1500 to 1508) implementing NEPA and FRA's Procedures for Considering Environmental Impacts (64 *Federal Register* 28545) (FRA and State of California 2019).[1,2,3]

CEQA (California Public Resources Code 21000 et seq.) and the CEQA Guidelines require state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, when feasible. California Public Resources Code 21100(b)(3) provides that an EIR will include a statement setting forth the mitigation measures proposed to minimize the significant impacts on the environment.

The requirements of NEPA and CEQA are not necessarily the same; similar requirements found in both statutes may have different performance criteria, and some requirements that appear in one statute may not appear in the other. In addition to NEPA and CEQA, the project is subject to additional federal and state environmental statutes and regulations, which also require analyses that must be incorporated into the EIR/EIS. For example, construction and operation of the project would require compliance with both federal and state regulations protecting endangered species. In circumstances where more than one regulation or statute might apply, this joint EIR/EIS has been prepared in compliance with the more stringent or inclusive set of requirements, whether federal or state. The timeline for construction of the project is provided in Section 2.10, Construction Plan.

The Authority has focused on avoiding and minimizing potential impacts through rigorous planning and thoughtful design, informed by the decisions made at the conclusion of the first-tier EIR/EIS process, including the adopted mitigation strategies.[4] The project alternatives described in Chapter 2, Alternatives, and analyzed in Chapter 3 incorporate as part of their description means to avoid and minimize impacts through design, compliance with applicable laws and regulations, and compliance with established industry standards, as reflected in Appendix 2-E, Project Impact Avoidance and Minimization Features. The project-level environmental analysis conducted for this Final EIR/EIS and described in this chapter includes consideration of means to avoid, minimize, and mitigate potential adverse environmental impacts. In balance with other considerations, the Authority has defined alignments along existing transportation corridors and rights-of-way to the extent feasible, while accommodating the appropriate project features and design standards, to minimize overall impact potential. Where necessary, this chapter identifies site-specific mitigation measures to further minimize potential project impacts, including those specific to each alternative alignment, proposed stations, and the other facilities.

3.1.2 State and Regional Policy Context

The California HSR System is an integral part of state and regional policy to improve mobility between the major metropolitan areas of the state and reduce statewide greenhouse gas (GHG)

---

[1] The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being or have been carried out by the State of California pursuant to 23 United States Code Section 327 and a Memorandum of Understanding dated July 23, 2019, and executed by the FRA and the State of California. The technical reports were prepared to support the EIR/EIS; however, many of the technical reports were prepared prior to the execution of the NEPA Assignment MOU and therefore still reflect FRA's involvement.

[2] While this EIR/EIS was being prepared, FRA adopted new NEPA compliance regulations (23 C.F.R. 771). Those regulations only apply to actions initiated after November 28, 2018. See 23 C.F.R. 771.109(a)(4). Because this EIR/EIS was initiated prior to that date, it remains subject to FRA's Environmental Procedures rather than the Part 771 regulations.

[3] The Council on Environmental Quality issued new regulations on July 14, 2020, effective September 14, 2020, updating the NEPA implementing procedures at 40 C.F.R. Parts 1500-1508. However, this project initiated NEPA before the effective date and is not subject to the new regulations, relying on the 1978 regulations as they existed prior to September 14, 2020. All subsequent citations to Council on Environmental Quality regulations in this environmental document refer to the 1978 regulations, pursuant to 40 C.F.R. 1506.13 (2020) and the preamble at 85 Fed. Reg. 43340.

[4] The Authority and FRA's *Final Program Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the Proposed California High-Speed Train System* was published in August 2005. The FRA's program-level commitments are set forth in the November 2005 Record of Decision (FRA 2005) and the Authority's program-level commitments are set forth in November 2005 Authority Resolution 5-01 (Authority 2005). The Authority's program-level commitments are set forth in the CEQA findings for the *Partially Revised Final Program EIR* and the *Mitigation Monitoring and Reporting Program*, both published on April 19, 2012. The FRA's program-level commitments are set forth in the December 2, 2008, Record of Decision for the *Bay Area to Central Valley High-Speed Train (HST) Final Program EIR/EIS.*

emissions. The transportation sector—predominantly the cars, aircraft, and trucks that move people and goods—is the largest contributor to the state's total GHG emissions. The HSR system would provide a direct reduction in GHG emissions by moving people from travel in personal vehicles and aircraft to a more energy-efficient mode of transportation. The HSR system would also indirectly promote a reduction in GHG emissions by providing opportunities for low-impact, transit-oriented development around HSR stations in major metropolitan areas.

California legislation to reduce GHG emissions includes Executive Order S-3-05, Assembly Bill (AB) 32, Executive Order B-30-15, and Senate Bill 375, which are described in Chapter 1, Section 1.2.4.4, Deterioration of Air Quality and Impact on Greenhouse Gas Emissions, of this Final EIR/EIS. Executive Order S-3-05 and AB 32 set target reductions for GHG emissions and require the California Air Resources Board to design and implement emission limits, regulations, and other measures to reduce statewide GHG emissions to 40 percent below 1990 levels by 2030. Senate Bill 375 built upon AB 32 by requiring regional transportation agencies to develop a *sustainable communities strategy* to reduce GHG emissions from auto trips. The sustainable communities strategy is now a component of each regional transportation plan in the state and a requirement of all local general plans.

Chapter 1, Section 1.3, Relationship to Other Agency Plans, Policies, and Programs, describes how the HSR system supports other state, regional, and local plans and policies. While the HSR system is intended and designed to implement state, regional, and local policies and laws related to transportation, GHG emissions, and sustainable communities, the project may not be consistent with some presently adopted regional or local policies or laws. Pursuant to CEQA Guidelines (Section 15125(d)), the FRA's Procedures for Considering Environmental Impacts (64 *Federal Register* 28555, item 15), and the CEQ's regulations implementing NEPA (40 C.F.R. § 1506.2(d)), each resource section in this chapter addresses inconsistencies or conflicts between the project and adopted regional or local plans or policies pertaining to particular resources. Where inconsistences are found, these discussions also describe efforts to reconcile inconsistencies or conflicts and explain the rationale for proceeding if full reconciliation is not feasible. Appendix 2-K, Policy Consistency Analysis, in Volume 2, Technical Appendices, of this Final EIR/EIS documents the consistency analysis for all pertinent regional and local plans or policies.

3.1.3 Changes between the Draft EIR/EIS and This Final EIR/EIS

This Final EIR/EIS is a "full" final document that includes the text of the Draft EIR/EIS with text and figure revisions made since publication of the Draft EIR/EIS. A vertical line in the margin indicates a substantive change in the text since publication of the Draft EIR/EIS; minor editorial changes and clarifications are not identified. In addition, substantive changes are summarized at the beginning of each chapter and resource topic section of Chapter 3, Affected Environment, Environmental Consequences, and Mitigation Measures. Section 3.20, Design Variants to Optimize Speed, of the Draft EIR/EIS has been removed from the Final EIR/EIS, and the content has been incorporated into each resource topic. The following resource topics are areas with no impact differences as a result of the inclusion of the design variants: Section 3.5, Electromagnetic Fields and Electromagnetic Interference; Section 3.6, Public Utilities and Energy; Section 3.8, Hydrology and Water Resources; Section 3.9, Geology, Soils, Seismicity, and Paleontological Resources; Section 3.10, Hazardous Materials and Waste; Section 3.11, Safety and Security; Section 3.13, Station Planning, Land Use, and Development; Section 3.14, Agricultural Farmland; Section 3.15, Parks, Recreation, and Open Space; Section 3.16, Aesthetics and Visual Quality; Section 3.17, Cultural Resources; and Chapter 4, Section 4(f)/6(f) Evaluation. Throughout the Final EIR/EIS, the IAMF and mitigation measure language has been modified to use the term "will" instead of the term "would."

3.1.4 Chapter 3 Purpose

Each resource section of this chapter describes the following five primary topics of environmental information:

- **Consistency with Plans and Laws**—Discussion of project inconsistency with adopted regional and local plans and policies.
- **Methods for Evaluating Impacts**—Methods used to analyze potential environmental impacts that would be caused by project alternatives and to determine the significance of those impacts under CEQA.
- **Affected Environment**—Existing environmental conditions in the areas that would be affected by the project.
- **Environmental Consequences**—Potential environmental impacts associated with constructing and operating the project alternatives.
- **Mitigation Measures**—Site-specific mitigation measures where impacts cannot be otherwise avoided or reduced through project features and design standards, best management practices during construction, or project operations.

The analyses address the impacts of the alternative alignments, stations, and other related HSR facilities described in Chapter 2, and identify key differences among the impacts of the four alternatives evaluated in this Final EIR/EIS. As described in Chapter 2, the project consists of a No Project Alternative and four end-to-end alternatives identified as Alternative 1, Alternative 2, Alternative 3, and Alternative 4. Each end-to-end alternative comprises five subsections. Table 3.1-1 shows the design options of each alternative by subsection. These design options are referred to throughout this chapter.

Table 3.1-1 San Jose to Central Valley Wye Design Options by Subsection

Subsection/Design Options	Alternative 1	Alternative 2	Alternative 3	Alternative 4
San Jose Diridon Station Approach				
Viaduct to Scott Blvd	–	X	X	–
Viaduct to I-880	X	–	–	–
Blended, at-grade	–	–	–	X
Monterey Corridor				
Viaduct	X	–	X	–
At-grade	–	X	–	–
Blended, at-grade	–	–	–	X
Morgan Hill and Gilroy				
Embankment to downtown Gilroy	–	X	–	–
Viaduct to downtown Gilroy	X	–	–	–
Viaduct to east Gilroy	–	–	X	–
Blended, at-grade	–	–	–	X
Pacheco Pass				
Tunnel	X	X	X	X
San Joaquin Valley				
Henry Miller Rd	X	X	X	X

Source: Authority 2019
X = present
– = absent
I-880 = Interstate 880

The analyses also evaluate impacts associated with related infrastructure changes required to accommodate the alternatives, such as roadway and interchange modifications and utility relocation. This chapter analyzes mitigation, impacts resulting from mitigation, and feasibility of mitigation. In addition, the Authority has developed two design variants intended to optimize train speed. The first, referred to as the DDV, is located north and south of Diridon Station and at the station platforms and, if adopted, would apply only to Alternative 4. The second, referred to as the TDV, is located at the two tunnels east of Gilroy and through the Pacheco Pass and would apply to all four alternatives. (See Chapter 2, Alternatives, for more detail.)

Analysts used many sources to prepare this document. Chapter 12, References, lists these sources.

3.1.5 Chapter 3 Organization

Chapter 3 presents each environmental resource topic in its own section, as follows:

- Section 3.2, Transportation*
- Section 3.3, Air Quality and Greenhouse Gases*
- Section 3.4, Noise and Vibration*
- Section 3.5, Electromagnetic Fields and Electromagnetic Interference
- Section 3.6, Public Utilities and Energy
- Section 3.7, Biological and Aquatic Resources *
- Section 3.8, Hydrology and Water Resources*
- Section 3.9, Geology, Soils, Seismicity, and Paleontological Resources*
- Section 3.10, Hazardous Materials and Wastes*
- Section 3.11, Safety and Security
- Section 3.12, Socioeconomics and Communities*
- Section 3.13, Station Planning, Land Use, and Development
- Section 3.14, Agricultural Farmland*
- Section 3.15, Parks, Recreation, and Open Space
- Section 3.16, Aesthetics and Visual Quality*
- Section 3.17, Cultural Resources*
- Section 3.18, Regional Growth
- Section 3.19, Cumulative Impacts

Effects on Schools

The analysis of the potential impacts of project alternatives on schools can be found in the following sections:

- 3.2, Transportation
- 3.3, Air Quality and Greenhouse Gases
- 3.4, Noise and Vibration
- 3.5, Electromagnetic Fields and Electromagnetic Interference
- 3.10, Hazardous Materials and Waste
- 3.11, Safety and Security
- 3.12, Socioeconomics and Communities
- 3.13, Station Planning, Land Use, and Development
- 3.15, Parks, Recreation, and Open Space
- 3.16, Aesthetics and Visual Quality

The above asterisks (*) in the list of Chapter 3 sections indicate topics that are supported by a technical report providing additional detailed technical analyses and data. Technical reports are available in electronic form by request on the Authority's website. In addition to the technical reports, Volume 2, Technical Appendices, provides detailed, resource-specific background information, data, and other evidence supporting the analyses and conclusions in this chapter. Appendix 3.1-A, Parcels within the HSR Project Footprint, in Volume 2 provides detailed mapping of the project footprint and parcels intersected by each of the project alternatives. As shown in the text box, analyses of impacts associated with schools are presented in multiple sections in Chapter 3.

3.1.6 Chapter 3 Content

To the extent possible, resource topics have been treated in a structurally consistent fashion; however, the particulars of some resources necessitate organizational variation. In general, each resource topic in Chapter 3 includes the sections discussed below.

3.1.6.1 Introduction

The introduction presents an overview of the resource topic and the issues considered in the analysis, with definitions of the relevant resource issues as appropriate. This section also identifies technical reports and appendices that support the analysis, and it lists other environmental resource sections with bearing on the subject.

3.1.6.2 Laws, Regulations, and Orders

This section identifies the federal and state regulatory framework relevant to project approvals or decisions for the resource topic. An inventory of pertinent regional and local plans and policies considered in the preparation of the analysis for each resource topic appears in Volume 2, Appendix 2-J, Regional and Local Plans and Policies.

Content of Resource Sections

Each resource section in Chapter 3 includes the following sections:

1. Introduction
2. Laws, Regulations, and Orders
3. Consistency with Plans and Laws
4. Methods for Evaluating Impacts
5. Affected Environment
6. Environmental Consequences
7. Mitigation Measures
8. Impacts Summary for NEPA Comparison of Alternatives
9. CEQA Significance Conclusions

3.1.6.3 Consistency with Plans and Laws

This section addresses CEQA and NEPA requirements to describe a proposed project's consistency or conflicts with applicable federal, state, and local land use and other plans and laws. CEQA Guidelines require that an EIR discuss any inconsistencies between the proposed project and applicable general plans, specific plans, and regional plans (CEQA Guidelines, § 15125(d)[5]). The CEQ regulations require a discussion of conflicts between a proposed undertaking and the objectives of federal, regional, state, local, and tribal[6] land use plans, policies, and laws, as well as a description of the extent to which the Authority would reconcile the inconsistencies (CEQ Regulations §§ 1502.16(c), 1506.2(d)).[7] A complete inventory of the inconsistencies between the project and adopted regional or local plans and policies, as well as a description of how the Authority has attempted to reconcile the inconsistencies, is documented by resource in Appendix 2-K, Policy Consistency Analysis.

3.1.6.4 Methods for Evaluating Impacts

This section defines the resource study areas (RSAs) for each topic (some topics require more than one RSA) and describes the methods used to evaluate the impacts of implementing the project alternatives. It also discusses the methods to evaluate impacts under NEPA and determine the significance of impacts under CEQA.

Definition of Resource Study Area

RSAs are the geographic boundaries in which the environmental investigations specific to each resource topic are conducted to determine the resource characteristics and project impacts. A resource topic may have more than one RSA depending on the types of resources present and the types of impacts being analyzed. The RSAs pertinent to each resource topic are described in each resource section (Sections 3.2 through 3.18) and for cumulative impacts (Section 3.19). Figure 3.1-1 illustrates the conceptual components of a typical RSA.

Each RSA covers a geography that includes:

- Area necessary to define characteristics and context of the resource

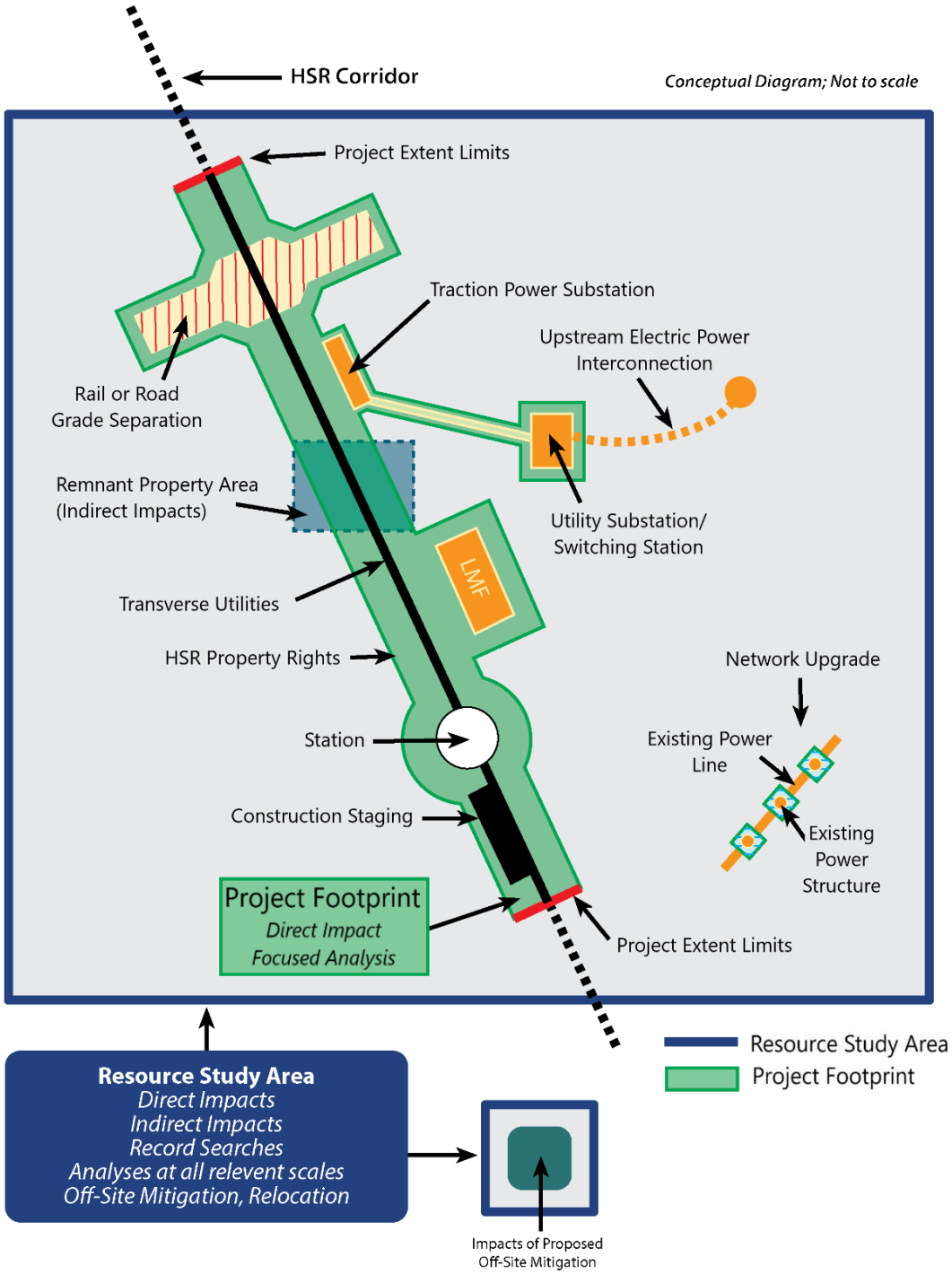
[5] All citations in this document to the "CEQA Guidelines" are references to the California Code of Regulations, Title 14, Division 6, Chapter 3, Sections 15000–15387.

[6] No designated tribal lands exist in the vicinity of the project alternatives and no analysis of tribal land use policies is provided.

[7] All citations to the CEQ Regulations are references to 40 C.F.R Part 1500.

- Facilities or features within the project footprint of each alternative and associated activities that could affect the resource
- Area necessary to determine the direct and indirect impacts (both beneficial and adverse) of the project alternatives

All RSAs encompass the project footprint, which includes the components and rights-of-way needed to construct and operate the project. Project footprint components include the proposed right-of-way and associated facilities, such as automatic train control, communications, and switching facilities, as well as the shifts in roadway rights-of-way associated with those facilities—including overcrossings and interchanges—that would be modified or shifted to accommodate the project, as described in Chapter 2.



Source: Adapted from Authority 2017

JUNE 2017

Figure 3.1-1 Typical Resource Study Area

The project footprint includes the following:

- **Right-of-way**—Alternatives 1, 2, and 3 would predominantly operate as a fully dedicated two-track system, requiring acquisition of right-of-way for operation and maintenance. The exception is the northernmost portion of the project extent, where, depending on the selected alternative, the system would maintain blended operations with Caltrain, predominantly using the existing Caltrain right-of-way. Alternative 4 would operate as a blended at-grade alignment, predominantly using the existing Caltrain and Union Pacific Railroad rights-of-way between San Jose and Gilroy, beyond which the system would be a fully dedicated two-track system.
- **Guideway**—The project would travel on different track types with varying profiles: low, near-the-ground tracks are at grade; higher tracks would be elevated in a viaduct or on an embankment; and below-grade tracks would be in retained cuts or tunnels. Types of water crossings that might be built include culverts such as box culverts and pipes, bridges with full channel spans, and for some wider river crossings, bridges with limited piers within the ordinary high-water channel.
- **Grade separations**—An optimal operating HSR system consists of a fully grade-separated and access-controlled guideway. Grade separations may occur in several scenarios: roadway overcrossings or undercrossings and elevated HSR road crossings.
- **Traction power substations**—Each traction power substation would encompass approximately 32,000 square feet (200 by 160 feet) at approximately 30-mile intervals adjacent to the HSR alignment.
- **Traction power switching and paralleling stations**—Each traction power switching station would need a site of approximately 14,400 square feet (160 by 90 feet), and each traction power paralleling station would need a site of approximately 9,600 square feet (120 by 80 feet) adjacent to the proposed HSR.
- **Utility switching stations**—Utility switching stations would encompass approximately 35,200 square feet (220 by 160 feet).
- **Communications facilities**—Within a fenced area of approximately 20 by 15 feet, 100-foot radio towers would be installed at intervals of approximately 1.5 to 3 miles. Where possible, communications equipment would be co-located with traction power substations or other HSR facilities.
- **Network upgrades**—Network upgrades to support the project's electrical load requirements would involve reconductoring existing 115-kilovolt power lines.
- **Utility connections**—The right-of-way required for new power transmission lines to provide a utility connection between electrical power substations and station switching facilities would be included in the project footprint. Fiber optic lines would also be required to support the electrical interconnections connecting the traction power substations to a new utility switching station and to existing PG&E facilities, typically within tie-line/utility corridors.
- **Utility relocations**—Project construction may require the relocation of existing utility lines. The additional right-of-way required to accommodate these relocations would be included in the project footprint.
- **HSR stations**—The existing San Jose Diridon Station and Gilroy Station would require modifications to accommodate HSR trains and additional passenger services. One new station could be built in east Gilroy.
- **Maintenance facilities**—The project would include two types of maintenance facilities: a maintenance of way facility and a maintenance of way siding.

- **Project-related roadway modifications**—Roadway modifications would have varying rights-of-way and would include new roadway undercrossings and overcrossings of the project guideway.
- **Temporary construction areas**—Areas needed during construction, such as construction staging and temporary construction easements, as well as areas that may be necessary for temporary relocation of facilities during the construction process, such as shoofly tracks.

The project would require property acquisition necessary for project operation. When the remnant portion of an acquired parcel beyond the right-of-way is too small to sustain current use without other modifications, or where access to a property cannot be provided, it would also be acquired. An example of a remnant portion of a property is shown in Figure 3.1-1. These remnant parcels may be used temporarily for construction and would be considered for sale after project construction if the Authority determines it has no long-term need for them. They would not be part of the finished project, nor would they be within the HSR right-of-way limits. However, the Authority may conduct various management and maintenance activities (e.g., vegetation management, site security) on such parcels. Property management activities would be designed to avoid impacts; if, once the actual site conditions are known and there would be potential for an impact, a separate environmental evaluation would be triggered.

The Authority would not acquire temporary construction staging areas through the right-of-way acquisition process. It would be the responsibility of the design-build contractor to negotiate with property owners to secure access and temporary use of the properties for staging or laydown areas.

The maintenance of way facility, maintenance of way siding, and other identified sites along the alignment would be considered for construction staging. Volume 2, Appendix 3.1-A, provides a map series of the project footprint for each project alternative.

Impact Avoidance and Minimization Features

IAMFs are project features that are considered to be part of the project and are included as applicable under all four project alternatives for purposes of the environmental impact analysis. The full text of each IAMF is provided in Appendix 2-E. Each resource section in Chapter 3 provides a list of applicable IAMFs relevant to the resource in the Environmental Consequences section, and the mechanisms by which the IAMFs will avoid and minimize impacts are described briefly in the individual impact discussions.

Methods for Impact Analysis

Each resource section describes the methods and data sources used for evaluating impacts on that resource. The methods for analysis vary by resource and rely on both quantitative and qualitative techniques. Where appropriate to evaluating the impacts, the Authority conducted fieldwork to collect data. These methods apply to both NEPA and CEQA analyses unless otherwise indicated.

Method for Evaluating Impacts under NEPA

In accordance with CEQ regulations (40 C.F.R. Parts 1500–1508), the analysis considers context and intensity to describe project effects. *Context* refers to the affected environment in which a proposed project occurs and may include affected interests or resources (e.g., residents, special-status species); the specific locality; the region; or society as a whole, depending on the resource. *Intensity* refers to the severity of the impact. The analysis of intensity encompasses the type (direct/indirect), extent (local, regional), and duration (temporary or permanent) of the impact; whether the action threatens a violation of federal or state law or requirements imposed for the protection of the environment; and other intensity considerations, as set forth in the CEQ NEPA regulations. Context and intensity are considered together when determining the severity of the change introduced by the project comparison with conditions under the No Project Alternative.

Method for Determining Significance under CEQA

CEQA requires an EIR to identify the significant environmental impacts of a project (CEQA Guidelines § 15126). One of the primary differences between NEPA and CEQA is that CEQA requires a threshold-based impact analysis. The Authority has established thresholds based predominantly on the CEQA Guidelines to determine the level of significance of impacts under CEQA and, where appropriate, the requirement for mitigation measures to reduce the magnitude and severity of impacts. If a threshold is exceeded, the impact is considered significant under CEQA. If mitigation does not reduce an impact below the threshold, the impact remains significant and unavoidable after mitigation. The thresholds of significance under CEQA are presented in each resource section.

3.1.6.5 Affected Environment

The description of the affected environment summarizes existing, baseline conditions of sensitive or protected resources that could be affected by the project, including their regional context. This section provides the basis and context for the environmental analysis and evaluation of impacts. The affected environment discussion identifies key resources, any resources specific to a given subsection, and their general location in the project extent, with supporting figures and tables showing the extent of each resource by subsection. The description is based on the most recent data available through public sources or collected during fieldwork.

3.1.6.6 Environmental Consequences

This section describes the potential environmental impacts of the No Project Alternative and the project alternatives. The explanations of impacts include the context, intensity, and duration of an impact. Each impact is identified by a name and number (e.g., Impact LU#1: Impacts on Land Use Patterns). Impacts are organized by construction and operations according to when and under what conditions impacts are expected to occur. As described in Chapter 2, the project alternatives are similar because of their geographic proximity and uniform design features; consequently, in many cases they would result in similar impacts. Figures illustrating the impacts and summary tables that convey the key differences among the end-to-end alternatives supplement the impact narrative.

The evaluation of impacts reflects integration of IAMFs that have been incorporated into the project alternatives, as described in Section 2.6.2.3, HSR Project Impact Avoidance and Minimization Features. This Final EIR/EIS labels and numbers IAMFs. For example, LU-IAMF#1, HSR Station Area Development: General Principles and Guidelines, applies to land use resources. IAMFs are required practices and project features that protect sensitive resources from project construction or operational activities. IAMFs may involve the development of a plan or program, such as a dust control plan to reduce impacts on air quality; or they may require or restrict an action, such as limiting delivery hours of construction materials to minimize impacts on traffic during peak travel times.

This Final EIR/EIS evaluates the impacts of the project alternatives on the existing environmental conditions in the project vicinity. The Final EIR/EIS also evaluates the impacts of the alternatives on the projected 2040 future environmental conditions without the project (No Project Alternative).[8] Projected future environmental conditions without the project are described under the heading “No Project Alternative” in the Environmental Consequences portion of each resource section. Some topic areas (transportation, air quality, and energy) include additional

[8] The CEQA Guidelines also require that an EIR examine “what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community service” (CEQA Guidelines § 15126.6(e)(2)). Similarly, NEPA requires that the alternatives analysis in an EIS “include the alternative of no action” (CEQ regulations 1502.14(d)). Accordingly, the No Project Alternative is included in this Final EIR/EIS to provide a basis for decision-makers and the public to compare the impacts of approving one of the San Jose to Merced project alternatives to the impacts of not approving any of the San Jose to Merced project alternatives. For a detailed description of the No Project Alternative, refer to Section 2.6.

discussion of the impacts of the project alternatives in the opening year of HSR operations, as described more specifically in the individual sections.

Each impact discussion that addresses a CEQA threshold also includes a subsection entitled CEQA Conclusion. The CEQA Conclusion sections identify the relevant CEQA threshold and describes how the project impacts would either exceed or not exceed the threshold. CEQA impacts are categorized as significant, less than significant, or no impact before mitigation.

NEPA and CEQA also require examination of a project's cumulative impacts (i.e., a project's impacts considered in conjunction with impacts of other past, present, and reasonably foreseeable projects causing related impacts). Section 3.19 evaluates cumulative impacts for each resource and considers the project's contribution to any cumulative impact.

Ridership Forecasts and Impacts Analysis

The ridership forecasts used in this environmental analysis correspond to forecasts in the 2016 Business Plan and are based on probability of occurrence. The annual *medium* forecast (42.8 million passengers) is lower than the *high* forecast (56.8 million passengers) but has a higher likelihood of occurrence (Authority 2016). For impact analyses that are related to the level of ridership on the HSR system, the medium- and high-ridership forecasts provide conservative estimates that have been applied as follows.

The high-ridership forecast (56.8 million passengers) provides for a conservative assessment of adverse impacts in these areas:

- Section 3.2, Transportation—Analysis of transportation effects from increased traffic around station areas
- Section 3.3, Air Quality and Greenhouse Gases—Analysis of localized air quality effects from increased traffic around station areas
- Section 3.4, Noise and Vibration—Analysis of noise effects from increased traffic around station areas
- Section 3.6, Public Utilities and Energy—Analysis of the electrical demands of train propulsion, stations, storage depots, and maintenance facilities

The use of the high-ridership forecast for these analyses yields a conservative disclosure of a higher level of adverse environmental impacts that could occur if ridership reaches the 2040 forecast of 56.8 million passengers. If HSR ridership proves to be lower than the 56.8 million forecast, adverse environmental impacts would also be lower. However, while a lower level of ridership would reduce adverse environmental impacts, it would also reduce the environmental benefits of the HSR system (e.g., transportation, air quality, energy).

The medium-ridership forecast (42.8 million) provides for a conservative assessment of environmental benefits in these areas:

- Section 3.2, Transportation—Analysis of traffic effects (vehicle miles traveled) on the regional highway network from reducing automobile trips
- Section 3.3, Air Quality and Greenhouse Gases—Analysis of air quality and GHG effects from reducing vehicle miles traveled, air travel, and energy use
- Section 3.6, Public Utilities and Energy—Analysis of energy effects from reducing fossil fuel consumption for automobile, air, and conventional rail travel

The use of the medium-ridership forecast for these analyses yields a conservative disclosure of a lower level of environmental benefit that could occur if ridership reaches the 2040 forecast of 42.8 million passengers rather than the higher forecast of 56.8 million riders. If HSR ridership proves to be higher than the 42.8 million forecast, environmental benefits would also be higher, but this scenario would also bring a higher level of impact.

Since the 2016 Business Plan forecasts were developed, the Authority adopted a 2018 Business Plan, which was accompanied by updated forecasts documented in Ridership & Revenue Forecasting Technical Supporting Documents (Authority 2016, 2018). The 2016 and 2018 Business Plan ridership forecasts were developed using the same travel forecasting model; the forecasts differ because of changes in the model's inputs, including the HSR service plan, demographic forecasts, estimates of automobile operating costs and travel times, and airfares. The medium ridership forecast for 2040 decreased by 6.5 percent, from 42.8 million to 40 million passengers, and the high ridership forecast decreased by 10.1 percent, from 56.8 million to 51.6 million passengers. In addition, the 2018 Business Plan assumes an opening year of 2033 rather than 2029 for the full Phase 1 system (Authority 2016, 2018).

The Authority released the *Draft 2020 Business Plan: Delivering the Vision* in February 2020 (Authority 2020). Subsequently, due to the ongoing COVID-19 pandemic uncertainty, the Draft 2020 Business Plan final adoption was extended to April 15, 2021. A Revised Draft 2020 Business Plan was issued on February 9, 2021, for public review and comment. The 2020 Business Plan was adopted by the Authority Board of Directors on March 25, 2021, and submitted to the state legislature on April 12, 2021. The 2020 Business Plan forecasts were developed using the same travel forecasting model as the 2016 and 2018 Business Plans, updated for population and employment forecasts. The 2020 Business Plan Phase 1 medium ridership forecast for 2040 is 38.6 million, and the high ridership forecast is 50.0 million (Authority 2021).

To the extent that the lower ridership levels projected in the 2018 Business Plan or the 2020 Business Plan would result in fewer trains operating in 2040, the adverse environmental impacts associated with the train operations in 2040 would be somewhat less than the impacts presented in this Final EIR/EIS, and the benefits accruing to the project (e.g., reduced vehicle miles traveled, reduced GHG emissions, reduced energy consumption) also would be somewhat less than the benefits presented in this Final EIR/EIS. As with the impacts, the benefits would continue to build and accrue over time and would eventually reach the levels discussed in this Final EIR/EIS for the Phase 1 system.

3.1.6.7 Mitigation Measures

This section identifies and describes proposed mitigation measures to avoid, minimize, rectify, reduce, eliminate, or compensate for impacts. NEPA requires federal agencies to identify potentially adverse effects and identify measures to mitigate those effects. CEQA requires that each significant impact of a project be identified and feasible mitigation measures be stated and implemented. Mitigation measures are identified for significant impacts from construction and operational activities that will not be sufficiently avoided or minimized through the IAMFs or by refining project design. The mitigation measures are based on the mitigation strategies presented in the *Final Program EIR/EIS for the Proposed California High-Speed Train System* (Authority and FRA 2005), *San Francisco Bay Area (Bay Area) to Central Valley High-Speed Train Final Program EIR/EIS* (Authority and FRA 2008), and *Bay Area to Central Valley High-Speed Train Partially Revised Final Program EIR* (Authority 2012), as they may apply to the project. The programmatic mitigation strategies in these program EIR/EISs provided a foundation for crafting mitigation measures in this project section, and additional mitigation measures were identified where appropriate. The mitigation measures that would be applied to the HSR project are abbreviated "MM" and numbered. For example, the first mitigation measure for air quality impacts is AQ-MM#1, and for aesthetics and visual quality it is AVQ-MM#1.

A discussion of potential secondary impacts resulting from implementation of each mitigation measure is provided after the full text of each measure. If, during project implementation changing facts or circumstances render mitigation infeasible, additional environmental review may be required. Should mitigation occur on property not owned by the Authority, coordination with the property owners involved, or with jurisdiction that regulates the property, will be required as described in Section 3.1.8, Legal Authority to Implement Off-Site Mitigation, for more information.

3.1.6.8 Impact Summary for NEPA Comparison of Alternatives

This section summarizes the environmental consequences specific to NEPA requirements for each resource. The NEPA impact summaries focus on any adverse effects using summary tables and narrative discussions to briefly describe the impact, the impact mechanism, a comparison of intensity—either qualitative or quantitative—between alternatives, the ameliorating influence of IAMFs, and any additional mitigation necessary. Table 3.1-2 shows an example of a NEPA summary table and its structure.

Table 3.1-2 Comparison of Project Alternative Impacts for Air Quality and Greenhouse Gases (Example)

Impacts	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact AQ#1: Temporary Direct and Indirect Impacts on Air Quality within the SFBAAB	Temporary construction activity would generate NO_X emissions in excess of the General Conformity *de minimis* threshold. Maximum annual NO_X emissions of 106 tons would occur in 2024. Annual construction emissions peak in 2024 due to concurrent construction of all four subsections within the SFBAAB, as well as construction of the Gilroy MOWF, San Jose Diridon Station, and Downtown Gilroy Station. Emissions of all other pollutants would be below the respective General Conformity *de minimis* thresholds.	Same as Alternative 1. Maximum annual NO_X emissions of 155 tons would occur in 2024, which is the year with the greatest amount of total construction activity in the SFBAAB.	Same as Alternative 1. Maximum annual NO_X emissions of 114 tons would occur in 2024, which is the year with the greatest amount of total construction activity in the SFBAAB.	Same as Alternative 1. Maximum annual NO_X emissions of 156 tons would occur in 2024, which is the year with the greatest amount of total construction activity in the SFBAAB.

NO_X = nitrogen oxides
SFBAAB = San Francisco Bay Area Air Basin

3.1.6.9 CEQA Significance Conclusions

This discussion summarizes the construction and operational impacts identified in the Environmental Consequences section and reports CEQA significance determinations. For each project alternative, this section uses summary tables and narrative discussion to identify mitigation measures that are available to reduce significant impacts and report the level of significance after mitigation. Table 3.1-3 shows an example of the information and table layout presented in this section.

Table 3.1-3 CEQA Significance Conclusions and Mitigation Measures for Air Quality and Greenhouse Gases (Example)

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measure	CEQA Level of Significance after Mitigation
Impact AQ#1: Temporary Direct and Indirect Impacts on Air Quality within the SFBAAB	Significant for all alternatives. Construction-related VOC and NOX emissions would exceed BAAQMD's thresholds.	AQ-MM#1: Implement Additional On-Site Emissions Controls to Reduce Fugitive Dust AQ-MM#2: Construction Emissions Reductions – Requirements for use of Zero Emission (ZE) and/or Near Zero Emission (NZE) Vehicles and off-road equipment AQ-MM#3: Offset Project Construction Emissions in the SFBAAB	Less than Significant

CEQA = California Environmental Quality Act
BAAQMD = Bay Area Air Quality Management District
NO_X = nitrogen oxides
SFBAAB = San Francisco Bay Area Air Basin
VOC = volatile organic compound

3.1.7 Outreach to Local Agencies

Meetings and other outreach activities were conducted with the staff of local public agencies throughout preparation of the EIR/EIS. These meetings and other outreach activities have helped the Authority understand the on-the-ground conditions and the local environmental issues, understand the concerns of local agencies and the public, facilitate reconciliation of substantive concerns, and design effective and feasible mitigation measures. Chapter 9, Public and Agency Involvement, describes the stakeholder involvement efforts undertaken during preparation of the Final EIR/EIS. Specific resource-related issues identified during this outreach are also discussed in the respective resource sections of the Final EIR/EIS.

3.1.8 Legal Authority to Implement Off-Site Mitigation

Chapter 3 analyzes the project's potential physical environmental impacts on various resource areas. If a potential significant impact is found, mitigation measures are proposed. Most mitigation measures identified are within the Authority's jurisdiction and control. Some of the proposed mitigation measures, however, will occur outside the project footprint on property the Authority would not own as part of its right-of-way acquisitions. These are sometimes referred to as *off-site mitigation measures*. Mitigation that will occur on property not owned by the Authority will require working with the property owners involved or with the jurisdiction that regulates the property to accomplish that mitigation.

The Authority has not identified any off-site mitigation measures that it believes are infeasible or unlikely to occur. The Authority will continue its current practice of developing memoranda of understanding and funding agreements with local governments to facilitate agreement on implementation of off-site mitigation measures on property owned at the local agency level, where required.

3.2 Transportation

Since publication of the Draft Environmental Impact Report (EIR)/Environmental Impact Statement (EIS), the following substantive changes have been made to this section:

- Analysis about the Diridon design variant (DDV) and tunnel design variant (TDV), which was included in Section 3.20 in the Draft EIR/EIS, was incorporated into this section.
- In Section 3.2.2.1, the Federal Transit Act was replaced with the Public Transportation Act (49 U.S.C. Chapter 53), which is the updated version of this law.
- A section was added to Section 3.2.2.1, regarding the Federal Railroad Administration (FRA) Procedures for Considering Environmental Impacts. Footnotes were added regarding FRA's Environmental Procedures and the updated Council on Environmental Quality (CEQ) regulations issued after release of the Draft EIR/EIS.
- In response to comments on the Draft EIR/EIS, Section 3.2.3, Consistency with Plans and Laws, was revised to clarify that all design options in the Area Development Policy (ADP) Improvement 8 policy (included in the Communications Hill Specific Plan ADP) for a Capitol Caltrain Station pedestrian/bicycle connection along Monterey Road (City of San Jose 2014a) remain feasible but may require use of an undercrossing instead of an overcrossing.
- Section 3.2.4.3, Methods for Impact Analysis, was updated to reference proposed parking facilities at the Downtown Gilroy Station (Alternatives 1, 2, and 4), East Gilroy Station (Alternative 3), and the proposed parking areas adjacent to San Jose Diridon Station to replace displaced permanent parking.
- Section 3.2.4.3 was revised to state that for the vehicle trip forecasts at high-speed rail (HSR) stations, parked car and taxi/transportation network company trips result in one vehicle trip per boarding or alighting while private vehicle drop-off/pickup trips result in two vehicle trips (one trip entering the site and another leaving the site) per boarding or alighting.
- Section 3.2.4.3 was revised to clarify that the analysis of operations impacts on freight service evaluated where the project would share passenger and freight rails based on potential changes in freight service access, routing, and operating hours due to the sharing of tracks north of the Santa Clara Station.
- Footnotes were added to Section 3.2.5.1, Vehicle Miles Traveled, to define total vehicle miles traveled (VMT) and interregional VMT.
- Section 3.2.5.3, San Jose Diridon Station and SAP Center Parking, and Impact TR#8 include clarification that the Santa Clara Valley Transportation Authority (VTA) parking "study" utilized in the analysis is a parking "inventory."
- Section 3.2.5.6, Freight Rail Service, was modified to update the description of existing freight operations using 2019 dispatch data.
- Section 3.2.5.6 was corrected to remove reference to a specific commuter service train speed (79 miles per hour) relative to the existing Caltrain Trackage Rights Agreement with Union Pacific Railroad (UPRR).
- Impact TR#3 was revised to identify one additional permanent road closure under Alternative 2; that is, closure of the cul-de-sac St. Agatha Lane (Morgan Hill and Gilroy Subsection). A typographical error in the number of permanent road closures under Alternative 1 was corrected in one place.
- Table 3.2-15 was updated to add clarifications about replacement parking areas.
- Impact TR#8 was revised to delete reference to involvement of Sharks Sports and Entertainment in VTA's prior evaluation of parking and to provide updates to the analysis of parking effects.

- Impact TR#9 was revised to include addition of the ongoing update to the Adopted Diridon Station Area Plan and the Diridon Integrated Station Concept Plan and to provide updates to the analysis of parking effects.
- The No Project Conditions under Section 3.2.6.4, Transit, was revised to include two new tables, Tables 3.2-17 and 3.2-18, which show the assumed passenger and freight train operations for 2029 and 2040.
- Impact TR#10 was revised to include additional information regarding the nature of impacts with Alternative 4.
- Impact TR#16 was revised to include additional information about the track and platform analysis at the San Jose Diridon Station.
- The reference to North Railroad Trail in Table 3.2-21 was modified to better describe the location of this connection.
- The No Project Conditions under Section 3.2.6.6, Freight Rail Service, was updated to revise the forecasted levels of freight trains based on the growth rates in the 2018 State Rail Plan.
- Impact TR#21 was revised to include additional information about potential effects on freight operations during project operations.
- Section 3.2.7, Mitigation Measures, was modified to include site-specific traffic mitigation measures under TR-MM#1 and an analysis of the potential for secondary effects due to these site-specific mitigation measures, to include provisions under TR-MM#2 that apply during construction, and to include additional detail for TR-MM#3 concerning minimizing effects on passenger and freight rail during construction. A column was added to the mitigation measures table to identify the relevant communities.
- Section 3.2.8, Impact Summary for NEPA Comparison of Alternatives, was modified to take into account the effect of the added site-specific traffic mitigation measures under TR-MM#1 and the revised TR-MM#2.
- In Section 3.2.8, Figure 3.2-11 was modified to incorporate new mitigation measures and divided into two figures to differentiate effects before and after mitigation. Table 3.2.25, Intersections with Adverse Effects after Mitigation, was added.
- Section 3.2.9, CEQA Significance Conclusions, was modified to take into account the effect of the revised TR-MM#2.
- Where appropriate, the verb “would,” when used specifically to describe impact avoidance and minimization features (IAMFs) or mitigation measures, as well as their directly related activities, was changed to “will,” indicating their integration into project design.
- A new Appendix 3.2-C, Traffic Mitigation Measures Screening, was added to provide the screening evaluation of potential site-specific traffic mitigation measures considered to address National Environmental Policy Act (NEPA) adverse effects related to traffic against California High-Speed Rail Authority (Authority) criteria for identifying traffic mitigation measures.

3.2.1 Introduction

This section describes the regulatory setting, affected environment, and potential impacts on transportation in the San Jose to Central Valley Wye Project Extent (project extent or project) resource study area (RSA) where transportation resources are susceptible to change. The discussion of California Environmental Quality Act (CEQA) impacts reflects California's shift in transportation impact analysis away from a focus on automobile delay, most commonly analyzed in terms of level of service (LOS), to a focus on VMT. This shift is intended to promote reduction in greenhouse gas (GHG) emissions from transportation, the development of multimodal transportation networks, and a diversity of land uses.

Primary Transportation Impacts

- The project would decrease overall vehicle miles of travel throughout Santa Clara, San Benito, and Merced Counties and improve transit linkages in the region and between southern and northern California.
- Project construction and operations would result in increases in vehicular congestion and delays and decreases in transit performance because of roadway narrowing between Capitol Expressway and Blossom Hill Road under Alternatives 1, 2, and 3.
- Project operations would result in increases in vehicle congestion and delay, decreases in transit performance in the San Jose Diridon Station Approach and the Morgan Hill and Gilroy Subsections because of increased HSR traffic generated by project trips under all alternatives and in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections because of increased gate down time at rail crossings.

In the project extent, the transportation resources likely to be affected are the transportation networks, including pedestrian, bicycle, transit (e.g., Bay Area Rapid Transit [BART], Caltrain, and bus service), and vehicular facilities near the HSR stations. In addition, development of the maintenance of way facility (MOWF) in east or south Gilroy would affect transportation facilities surrounding the proposed locations. Construction and operations of Alternatives 1, 2, and 3 would also involve narrowing Monterey Road from its existing six-lane cross section to four lanes from roughly Capitol Expressway to Blossom Hill Road. Various project alternatives also include modifications to the existing and planned roadway networks to accommodate the project. Operations of Alternative 4 would result in increased gate down time at the at-grade crossings between San Jose and Gilroy, affecting nearby roadway intersections. The project does not cross any navigable waterways and thus will have no effect on marine navigation; therefore, this topic is not discussed further in this document.

The *San Jose to Merced Project Section Transportation Technical Report* (Transportation Technical Report) (Authority 2019) provides additional support for this transportation analysis. The following appendices in Volume 2 of this EIR/EIS provide additional details on transportation:

- Appendix 2-A, Roadway Crossings, Modifications, and Closures, lists all proposed roadway modifications associated with each of the project alternatives as well as details of proposed four-quadrant gate at-grade crossings.
- Appendix 2-B, Railroad Crossings, describes railroad crossings of the project.
- Appendix 2-D, Applicable Design Standards, describes the relevant design standards for this project.
- Appendix 2-E, Impact Avoidance and Minimization Features, provides the list of all IAMF incorporated into this project.
- Appendix 2-J, Regional and Local Policies, provides a list by resource of all applicable regional and local plans and policies.
- Appendix 2-K, Policy Consistency Analysis, provides a summary by resource of project inconsistencies and reconciliations with local plans and policies.

- Appendix 3.2-A, Transportation Data on Roadways, Freeways, and Intersections, provides data used in the analysis of potential impacts on roadways, freeways, and intersections. A summary of intersection LOS and NEPA effects is also provided.
- Appendix 3.2-B, Vehicle Miles Traveled Forecasting provides a summary memorandum from the Authority and a technical paper written by Cambridge Systematics describing the methodology used for forecasting the reduction in VMT.
- Appendix 3.2-C, Traffic Mitigation Measures Screening, provides the screening evaluation of potential site-specific traffic mitigation measures considered to address NEPA adverse effects related to traffic against Authority criteria for identifying traffic mitigation measures.

The following resource sections provide additional information related to transportation:

- Section 3.3, Air Quality and Greenhouse Gases, evaluates transportation-related air quality and GHG impacts of the project.
- Section 3.4, Noise and Vibration, evaluates transportation-related noise and vibration impacts of the project.
- Section 3.11, Safety and Security, evaluates impacts on safety and security, including hazards, emergency access and emergency vehicle response times, and facility security.
- Section 3.12, Socioeconomics and Communities, evaluates impacts on community character and cohesion, including those associated with changes in roadway networks that may reshape communities, and evaluates the economic impacts on school districts associated with permanent changes to school bus routes.
- Section 3.13, Station Planning, Land Use, and Development, evaluates changes to land use and development patterns.
- Section 3.18, Regional Growth, evaluates impacts on regional growth, construction and operations employment, and the potential for the project to induce growth related to population and employment.
- Section 3.19, Cumulative Impacts, evaluates the cumulative impacts of the project in combination with other plans, programs, and projects.
- Chapter 5, Environmental Justice, considers transportation impacts in the context of low-income communities and minority communities.

This Section 3.2 and its supporting technical appendix include discussion and analysis based on automobile delay/congestion based on LOS and its related volume/capacity (V/C) ratio metric. California has adopted a policy through Senate Bill (SB) 743 and associated regulations (CEQA Guidelines 15064.3) that delay and congestion increases, by themselves, are not significant impacts on the environment under CEQA. However, delay/congestion increases caused by a project can lead to significant secondary impacts on the environment, such as air quality and noise. Accordingly, this document retains discussion and analysis of LOS and V/C changes the project might cause as an analytical input into evaluating the potential for significant environmental impacts in these other areas. In contrast, this analysis considers traffic congestion to be an environmental effect under NEPA as described in Section 3.2.4.4, Method for Evaluating Impacts under NEPA.

3.2.2 Laws, Regulations, and Orders

Federal and state laws, regulations, orders, and plans applicable to transportation affected by the project are presented in this section. The Authority would implement the HSR system, including the project, in compliance with all federal and state regulations. Regional and local plans and policies relevant to transportation considered in the preparation of this analysis are provided in Volume 2, Appendix 2-J, Regional and Local Policies.

3.2.2.1 Federal

Federal law requires the State of California to prepare the Federal Statewide Transportation Improvement Program every 4 years. This program compiles all projects that have been programmed throughout the state using federal funds.

In accordance with the Federal Passenger Rail Investment and Improvement Act of 2008, the State of California adopted the *2018 California State Rail Plan* in September 2018. Federal law requires the State of California to update its California State Rail Plan every 5 years as a condition of eligibility for federal funding for HSR and intercity passenger rail programs.

Federal law does not directly stipulate criteria for the analysis of federal aid-eligible roadways and highways. However, certain conditions must be met in order to maintain the funding eligibility of facilities. Federal agencies such as the Federal Highway Administration, Federal Transit Administration, and FRA are also delegated the authority to interpret and enforce most federal environmental protection laws.

Federal Railroad Administration, Procedures for Considering Environmental Impacts (64 Fed. Reg. 28545)

On May 26, 1999, FRA released *Procedures for Considering Environmental Impacts* (FRA 1999). These FRA procedures supplement the Council on Environmental Quality Regulations (40 C.F.R. Part 1500 et seq.) and describe the FRA's process for assessing the environmental impacts of actions and legislation proposed by the agency and for the preparation of associated documents (42 U.S. Code 4321 et seq.).[1,2] The FRA *Procedures for Considering Environmental Impacts* states that "the EIS should identify any significant changes likely to occur in the natural environment and in the developed environment. The EIS should also discuss the consideration given to design quality, art, and architecture in project planning and development as required by U.S. Department of Transportation Order 5610.4." These FRA procedures state that an EIS should consider possible impacts on transportation.

Railroad Revitalization and Regulatory Reform Act of 1976 (45 U.S.C. § 801)

The Railroad Revitalization and Regulatory Reform Act provides the means to rehabilitate and maintain the physical facilities, improve the operations and structure, and restore the financial stability of the nation's railway systems and to promote its revitalization.

Public Transportation Act (49 U.S.C. Chapter 53)

The purposes of Chapter 53 of Title 49 of the United States Code are to (1) provide funding to support public transportation; (2) improve the development and delivery of capital projects; (3) establish standards for the state of good repair of public transportation infrastructure and vehicles; (4) promote continuing, cooperative, and comprehensive planning that improves the performance of the transportation network; (5) establish a technical assistance program to assist recipients under this chapter to more effectively and efficiently provide public transportation service; (6) continue Federal support for public transportation providers to deliver high quality service to all users, including individuals with disabilities, seniors, and individuals who depend on public transportation; (7) support research, development, demonstration, and deployment projects dedicated to assisting in the delivery of efficient and effective public transportation service; and (8) promote the development of the public transportation workforce.

---

[1] While this EIR/EIS was being prepared, FRA adopted new NEPA compliance regulations (23 C.F.R. 771). Those regulations only apply to actions initiated after November 28, 2018. See 23 C.F.R. 771.109(a)(4). Because this EIR/EIS was initiated prior to that date, it remains subject to FRA's Environmental Procedures rather than the Part 771 regulations.

[2] The Council on Environmental Quality issued new regulations on July 14, 2020, effective September 14, 2020, updating the NEPA implementing procedures at 40 C.F.R. Parts 1500-1508. However, this project initiated NEPA before the effective date and is not subject to the new regulations, relying on the 1978 regulations as they existed prior to September 14, 2020. All subsequent citations to Council on Environmental Quality regulations in this environmental document refer to the 1978 regulations, pursuant to 40 C.F.R. 1506.13 (2020) and the preamble at 85 Fed. Reg. 43340.

Highways, Statewide Planning (23 U.S.C. § 135)

Title 23 of the United States Code (U.S.C.) for Highways and Statewide Planning provides the general requirements for statewide planning to encourage and promote the safe and efficient management, operation, and development of surface transportation system.

3.2.2.2 State

Designated state route and interstate highway facilities are under the jurisdiction of the California Department of Transportation (Caltrans) and the California Transportation Commission (CTC), except where management of the facility has been delegated to the county transportation authority. Caltrans and the CTC are responsible for producing a long-range transportation plan for the planning of statewide facilities. Caltrans and the CTC are also responsible under California law for assembling a statewide short-term improvement plan called the Statewide Transportation Improvement Program (STIP). California law requires the State of California to prepare this document every 2 years. The STIP (which often is prepared prior to the Federal Statewide Transportation Improvement Program document) compiles all projects programmed through the state using state or federal funds.

California Transportation Plan 2040

The California Transportation Plan was published in 2016 and provides a long-range policy framework to meet the state's future mobility needs and reduce GHG emissions. The California Transportation Plan defines goals, performance-based policies, and strategies to achieve the state's vision for California's future statewide, integrated, multimodal transportation system. The plan envisions a sustainable system that improves mobility and enhances the quality of life.

State Rail Plan (Gov. Code, § 14036)

This law requires Caltrans to produce a State Rail Plan that includes a passenger and freight rail component. The *California State Rail Plan* (Caltrans 2018) was developed to meet this requirement. It establishes a statewide vision and objectives, sets priorities, and develops policies and implementation strategies to enhance passenger and freight rail service in the public interest. It also details a long-range investment program for California's passenger and freight infrastructure.

Sustainable Communities and Climate Protection Act of 2008 (SB 375, Chapter 728, Statutes of 2008) and Global Warming Solutions Act (AB 32)

Adopted in September 2008, SB 375 provides a new planning process to coordinate community development and land use planning with regional transportation plans (RTP) to reduce sprawling land use patterns and dependence on private vehicles and thereby reduce VMT and GHG emissions associated with VMT. SB 375 is one major tool being used to meet the goals in Assembly Bill (AB) 32, the Global Warming Solutions Act. Under SB 375, the California Air Resources Board sets GHG emissions reductions targets for 2020 and 2035 for metropolitan planning organizations in the state. Each metropolitan planning organization must then prepare a sustainable communities strategy (SCS) that meets the GHG emissions reduction targets set by the board. Once adopted, the SCS is incorporated into the region's RTP.

Senate Bill 743 and CEQA Guidelines Section 15064.3

SB 743, codified in Public Resources Code Section 21099, created a shift in transportation impact analysis under CEQA from a focus on automobile delay as measured by LOS and similar metrics toward a focus on reducing VMT and GHG emissions. The Legislature required the Governor's Office of Planning and Research (OPR) to propose new criteria for determining the significance of transportation. The statute states that upon certification of the new criteria, automobile delay, as described solely by LOS or similar measures of vehicular capacity or traffic congestion, shall not be considered a significant impact on the environment under CEQA, except in any locations specifically identified in the new criteria. Lead agencies are still required to analyze a project's potentially significant transportation impacts related to air quality, noise, safety, and other resource areas that may be associated with transportation. The statute states that the adequacy of parking for a project shall not support a finding of significance.

The new criteria, contained in CEQA Guidelines Section 15064.3, was certified and adopted in December 2018. Section 15064.3 provides that VMT is the most appropriate metric to assess transportation impacts with limited exceptions (applicable to roadway capacity projects, which this project is not). A project's effect on automobile delay does not constitute a significant environmental impact. Other relevant considerations may include the project's effects on transit and nonmotorized travel. Section 15064.3 further provides that transportation projects that reduce VMT should be presumed to cause a less-than-significant impact. A lead agency can elect to be governed by Section 15064.3 immediately (which the Authority has done), and is required to shift to a VMT metric by July 1, 2020.

OPR has provided a technical advisory on evaluating transportation impacts in CEQA (OPR 2018a) and further information related to the change in Guidelines in its 2018 Statement of Reasons supporting the guideline change (OPR 2018b), and related to LOS and VMT on its CEQA Update website (OPR 2018c).

3.2.2.3 Regional and Local

City and county plans, including regional transportation plans, general plans, downtown master plans, community plans, and specific plans address transportation. Goals, policies, and regulations include design guidelines, transportation system efficiencies, and strategies to improve circulation. All regional and local policies applicable to the project are listed in Volume 2, Appendix 2-J.

Regional Transportation Plans (Gov. Code § 65080)

The State of California requires each transportation planning agency to prepare and adopt an RTP directed at achieving a coordinated and balanced regional transportation system.

Relevant objectives, policies, and goals from *Plan Bay Area 2040*, *Merced County Regional Transportation Plan*, *Moving Forward 2035 Monterey Bay* (Association of Bay Area Governments [ABAG] and Metropolitan Transportation Commission [MTC] 2017) and the Caltrain Strategic Plan applicable to the project are provided in Volume 2, Appendix 2-J.

California Streets and Highways Code (§ 1 et seq.)

California Streets and Highways Code Section 1 et seq. includes the provisions and standards for administration of the statewide streets and highways system. Designated state route and interstate highway facilities are under the jurisdiction of Caltrans, except where management of the facility has been delegated to local jurisdictions. Operations analysis of Caltrans facilities is conducted according to the methodology set forth in the *Guide for the Preparation of Traffic Impact Studies* (Caltrans 2002).

Caltrans uses the methods outlined in the *Highway Capacity Manual* (Transportation Research Board 2010) and has a target threshold of LOS C for intersections and highway facilities. The Caltrans guide provides guidelines for determining project fair-share contributions (Caltrans 2002).

3.2.3 Consistency with Plans and Laws

As indicated in Section 3.1.6.3, Consistency with Plans and Laws, CEQA and CEQ regulations require a discussion of inconsistencies or conflicts between a proposed undertaking and federal, state, regional, or local plans and laws. As such, this Final EIR/EIS describes the inconsistency of the project alternatives with federal, state, regional, and local plans and laws to provide planning context.

There are a number of federal and state laws and implementing regulations, listed in Section 3.2.2.1, Federal, and Section 3.2.2.2, State, that direct the transportation analyses for projects. These include the Railroad Revitalization and Regulatory Reform Act of 1976, Federal Transit Act, California Transportation Plan 2040, and the State Rail Plan.

The Authority, as the lead agency proposing to construct and operate the HSR system, is required to comply with all federal and state laws and regulations and to secure all applicable federal and state permits prior to initiating construction on the selected alternative. Therefore,

there would be no inconsistencies between the project alternatives and these federal and state laws and regulations. The HSR system as a whole, including the San Jose to Central Valley Wye Project Extent, is consistent with the California Transportation Plan 2040, the 2018 California State Rail Plan, and SB 743.

The Authority is not required to comply with local transportation regulations; however, it has endeavored to design and build the project so that it is consistent with local transportation goals. For example, the project alternatives incorporate IAMFs that include restricting construction hours and parking for construction vehicles, maintaining truck routes and access for special events during construction, maintaining bicycle and pedestrian access, protecting freight and passenger rail services, maintaining transit access, and meeting design standards and guidance for transportation facilities. The Authority reviewed 17 plans and 241 policies. The project alternatives are consistent with 237 policies and inconsistent with 4 policies set forth in the following general plans:

- Santa Clara County General Plan—Policy C-TR 12: The project would cause some intersections under County jurisdiction to operate at worse than the target LOS of D or better, resulting in an inconsistency with the County's LOS policy.
- City of San Jose General Plan—Goal TR-5.3: The project would cause some intersections under City jurisdiction to operate at worse than the target LOS of D or better, resulting in an inconsistency with the City's LOS policy.
- City of Morgan Hill General Plan—Policy TR-3.4: The project would cause some intersections under City jurisdiction to operate at worse than the target LOS of D or better, resulting in an inconsistency with the City's LOS policy. Alternative 2 would be inconsistent with the Transportation Element in regard to the proposed cul-de-sac on Tilton Avenue compared to the maintenance of the existing road connection to Monterey Road shown in the General Plan.
- City of Gilroy General Plan—Policy 12.08, Standard Level of Service: The project would cause some intersections under City jurisdiction to operate at worse than the target LOS of D or better, resulting in an inconsistency with the City's LOS policy.

All design options in the ADP Improvement 8 policy (included in Communications Hill Specific Plan ADP) for a Capitol Caltrain Station pedestrian/bicycle connection along Monterey Highway (City of San Jose 2018) would remain feasible with implementation of the HSR project but may require use of an undercrossing instead of an overcrossing. Appendix 2-K, Policy Consistency Analysis, provides further details on the inconsistencies and reconciliations with plans and laws of local jurisdictions. While implementation of the project would result in an increase in congestion on certain roadway segments and intersections, it would reduce regional VMT. The project would also support a shift to transit-oriented development (TOD) in station areas, to reduce reliance on the private automobile. The project would not address congestion through capacity improvements. It should also be noted that each of these jurisdictions became fully compliant with SB 743 on July 1, 2020, entailing a shift from LOS to VMT in their policies.

3.2.4 Methods for Evaluating Impacts

The evaluation of impacts on transportation is a requirement of NEPA and CEQA. The following sections summarize the RSAs and the methods used to analyze transportation. As summarized in Section 3.2.1, Introduction, other resource sections in this EIR/EIS also provide information related to transportation.

3.2.4.1 Definition of Resource Study Area

As defined in Section 3.1, Introduction, RSAs are the geographic boundaries within which analysts conducted the environmental investigations specific to each resource topic. The RSA for impacts on transportation encompasses the areas directly or indirectly affected by project construction and operations. These areas include the project footprint for each project alternative and the transportation network facilities providing access to the project footprint.

Direct long-term transportation impacts on roadways, intersections, transit facilities, bicycle facilities and pedestrian facilities are permanent changes necessary to implement the project alternatives. The RSA for direct impacts includes the project footprint for each project alternative. Indirect impacts on transportation facilities are changes to travel patterns resulting from implementation of the project alternatives (e.g., increases in traffic around stations and maintenance facilities, changes in circulation patterns resulting from narrowing Monterey Road from six to four lanes). The RSA for indirect impacts varies by facility type (i.e., roadways, freeways and intersections, transit, nonmotorized travel, and freight rail), as shown in Table 3.2-1.

Table 3.2-1 Definition of Transportation Resource Study Areas

Source	General Definition
Roadways, Freeways, Intersections	
Direct impacts	Project footprint
Indirect impacts	Includes major state routes for regional access; regionally significant roadways as defined by the Santa Clara Valley Transportation Authority, Congestion Management Programs, and relevant general plans; and regional truck routes that could be affected by project construction. The indirect RSA for roadways, freeways, and intersections includes critical intersections of station access points and regionally significant roadways located between the station and adjacent state highways and critical intersections of regionally significant roadways near the Monterey Road lane reduction affected by changes in travel patterns. Freeway segments that would serve 100 or more project-generated trips in either the AM or PM peak hour and intersections of roadways classified as a collector or above that would be physically modified by the project or would serve 50 or more project trips in either the AM or PM peak hour are considered to be affected by the project.[1]
Transit	
Direct impacts	Project footprint
Indirect Impacts	Includes regional and local bus transit service and passenger rail service that could be affected by project construction, including existing and planned public transit systems serving HSR stations in the project extent and ground transit facilities affected by changes in travel patterns because of the Monterey Road lane reduction.
Nonmotorized Travel	
Direct impacts	Project footprint
Indirect impacts	Includes infrastructure for pedestrian and bicycle transportation that could be affected by project construction, as well as existing and planned pedestrian and bicycle facilities within 500 feet of the project footprint.
Freight Rail	
Direct impacts	Project footprint
Indirect impacts	Includes freight rail track and systems that would be affected by project construction and existing freight rail facilities within 500 feet of the project footprint.

Source: Authority 2019a
RSA = resource study area
HSR = high-speed rail
[1] The Authority excluded some very low volume intersections, as impacts could not be reasonably anticipated at these locations. Typically, if an intersection had fewer than approximately 200 vehicles on the minor street, analysts considered it low volume. The Authority also considered other factors such as the context of the land use around that intersection and the proximity to the project alignment or other geometric changes (e.g., some intersections had more volume but were ruled out based on distance from the project alignment; some intersections had less volume but were near a station/roadway change).

3.2.4.2 Impact Avoidance and Minimization Features

IAMFs are project features that are considered to be part of the project and are included as applicable in each of the alternatives for purposes of the environmental impact analysis. The full text of the IAMFs that are applicable to the project is provided in Appendix 2-E. The following IAMFs are applicable to the transportation analysis:

- TR-IAMF#1: Protection of Public Roadways during Construction
- TR-IAMF#2: Construction Transportation Plan
- TR-IAMF#3: Off-Street Parking for Construction-Related Vehicles
- TR-IAMF#4: Maintenance of Pedestrian Access
- TR-IAMF#5: Maintenance of Bicycle Access
- TR-IAMF#6: Restriction on Construction Hours
- TR-IAMF#7: Construction Truck Routes
- TR-IAMF#8: Construction during Special Events
- TR-IAMF#9: Protection of Freight and Passenger Rail during Construction
- TR-IAMF#10: Off Peak Hour Employee Work Shift Changes at HMF
- TR-IAMF#11: Maintenance of Transit Access
- TR-IAMF#12: Pedestrian and Bicycle Safety
- LU-IAMF#2: Station Area Planning and Local Agency Coordination

This environmental impact analysis considers these IAMFs as part of the project design. Within Section 3.2.6, Environmental Consequences, each impact narrative describes how these project features are applicable and, where appropriate, effective at avoiding or minimizing potential impacts to less than significant under CEQA.

3.2.4.3 Methods for Impact Analysis

Overview of Impact Analysis

This section describes the sources and methods used to analyze potential impacts of the project alternatives on transportation. The following sections present the data collection efforts, analysis scenarios, measures of effectiveness, travel demand forecasting methods, and means for the evaluation of impacts on transportation.

Travel Demand Forecasts and Calculation of Vehicle Miles Traveled

Analysts developed ridership forecasts for the HSR system using the latest version of the statewide California High-Speed Rail Ridership and Revenue Model in *California High-Speed Rail Ridership and Revenue Model, Business Plan Model Version 3* (Authority 2016c). The model incorporates socioeconomic growth assumptions (population, housing, and employment forecasts) consistent with the California Statewide Travel Demand Model and adjusts them for the 2029 and 2040 forecast years. The statewide conventional passenger rail and urban transit networks are consistent with current and planned routes in the 2013 *California State Rail Plan* (Caltrans 2013) and plans for individual regional rail operators. The Authority provided station mode of access forecasts (Authority 2016b). Analysts estimated the vehicle trip forecasts through the analysis of comparable systems, the local context at each HSR station, existing conditions and constraints, planned land uses, transportation facilities and services, vehicle parking availability, and the mode-of-access forecasts.

VMT on roadway networks is a performance measure highly correlated to transportation GHG emissions. VMT is calculated based on the number of vehicles multiplied by the distance traveled by each vehicle. The Ridership and Revenue Model was used to forecast annual VMT for Santa Clara County, San Benito County, and Merced County under future conditions. Appendix 3.2-B, Vehicle Miles Traveled Forecasting, describes the methodology used for forecasting the reduction in VMT.

Analysts developed forecasts of vehicles that would travel on the freeways and roads in the RSA using a version of the VTA model developed by VTA staff for the San Mateo City/County Association of Governments (VTA 2017a), and subsequently enhanced to develop ridership forecasts for the Caltrain Peninsula Corridor Electrification Project (PCEP) EIR (Peninsula

Corridor Joint Powers Board [PCJPB] 2015). This forecasting tool was identified as the most appropriate for the project because it was used to develop Caltrain ridership forecasts and encompasses all the RSA intersections and freeway segments, as well as San Mateo and San Francisco Counties to the north.

Analysts enhanced the VTA model to include HSR in order to develop vehicle forecasts for this analysis. The socioeconomic datasets used as inputs to prepare the forecasts are based on the *Bay Area Regional Projections* (ABAG 2013). These datasets are accepted by the MTC to reflect regional model consistency for models used by the Congestion Management Agencies and were used to develop the regional travel demand forecasts for *Plan Bay Area 2040*, the current RTP and SCS for the San Francisco Bay Area (Bay Area) (ABAG and MTC 2017). Analysts incorporated HSR into the model by adding a new transit line along the planned alignment, with the four HSR stations in the Bay Area (i.e., San Francisco, Millbrae, San Jose Diridon, and Gilroy) and forecast HSR operating speeds by segment. Analysts then adjusted the model to match the HSR ridership and mode of access forecasts. In addition to incorporating HSR, analysts reviewed planned improvements to 2040 No Project highway and transit networks in the VTA model and found them to be consistent with the MTC's RTP and the SCS regional model.

The Authority used intersection and freeway LOS analytical methods to evaluate the vehicular traffic impacts from the HSR stations and the MOWF. The Authority determined the 2029 and 2040 No Project traffic volumes for the RSA stations and MOWF sites by using city-specific growth factors obtained from the VTA travel demand model. The growth factors were applied to the existing volumes to arrive at the future No Project volumes for the RSA intersections. In the segment where Monterey Road would be narrowed from six lanes to four lanes,[3] analysts prepared model runs to indicate any diversion in vehicle traffic that would occur. The Authority manually added vehicle trips generated by the HSR stations and MOWF alternatives to the 2029 and 2040 No Project traffic volumes based on distribution data derived from the VTA model to estimate the project-related traffic volumes.

Station Boardings and Alightings

The *Connecting and Transforming California: 2016 Business Plan* (2016 Business Plan) (Authority 2016a) documents 2029 and 2040 Plus Project ridership forecasts based on the *California High-Speed Rail Ridership and Revenue Model, Business Plan Model Version 3* (Authority 2016c). Table 3.2-2 shows the 2029 and 2040 Plus Project ridership (including boardings, alightings, and total daily passenger trips) for San Jose Diridon Station and the two potential Gilroy station locations.

Table 3.2-2 2029 and 2040 Ridership at High-Speed Rail Stations

Station	Daily Boardings[1]	Daily Alightings[2]	Total Daily Passenger Trips
2029 Ridership			
San Jose Diridon	7,250	7,250	14,500
Downtown Gilroy	2,950	2,950	5,900
East Gilroy	2,950	2,950	5,900
2040 Ridership			
San Jose Diridon	15,450	15,450	30,900
Downtown Gilroy	6,200	6,200	12,400
East Gilroy	6,200	6,200	12,400

Source: Authority 2016c
HSR = high-speed rail

[3] This capacity reduction, achieved by removing lanes, is often referred to as a *road diet*.

[1] Boardings account for passengers departing on HSR trains.
[2] Alightings account for passengers arriving on HSR trains.

Station Passenger Trip Generation by Mode of Access/Egress

The Authority applied station mode-of-access and egress forecasts to ridership estimates to determine the numbers of trips by mode at each station (Authority 2016b). Table 3.2-3 illustrates the passenger trips by mode of access and egress at the HSR stations in the RSA forecast for 2029 and 2040.

These estimates account for constrained vehicle parking; the provision of on-site parking would not meet total unconstrained project-related demand at all stations. Constrained vehicle parking could influence passengers to access the station area via transit rather than auto. Unmet needs for parking would be accommodated off site. There would be no rental car facilities located in the project footprint. Like unmet vehicle parking, all rental car facilities would be located off site.

The project does not include the construction of off-site parking facilities for construction or operational purposes, other than the proposed parking facilities at the Downtown Gilroy Station (Alternatives 1, 2, and 4), East Gilroy Station (Alternative 3), and the proposed parking areas adjacent to San Jose Diridon Station to replace displaced permanent parking. Vehicle trips to existing off-site rental car or parking facilities were assigned to areas where these resources are currently available. Passenger trips associated with satellite parking or rental car facilities were included as shuttle trips at the station level.

Station Vehicle Trip Generation

The Authority developed station vehicle trip generation estimates based on passenger trip generation estimates for vehicle access modes. Passenger trips were converted to vehicle trips using vehicle occupancy factors for park-and-ride, drop off, pick up, taxi, transportation network company, and shuttle trips. Peak hour vehicle trips were calculated by applying a peak hour conversion factor of 10 percent to daily trip totals.

Table 3.2-3 2029 and 2040 Passenger Trip Generation at High-Speed Rail Stations[1]

Station	Total Daily Passenger Trips[2]	Daily Passenger Trips by Mode of Access/Egress[3]						
		Parked Car: On Site	Parked Car: Off Site	Drop Off/ Pick Up	Taxi/ TNC	Rental Car Shuttle	Bus/ Rail	Walk/ Bike
2029 Passenger Trips								
San Jose Diridon	14,500	340	750	1,700	2,800	1,100	5,800	2,000
Downtown Gilroy	5,900	1,000	0	1,000	1,300	940	1,100	500
East Gilroy	5,900	1,600	0	880	1,600	1,500	260	60
2040 Passenger Trips								
San Jose Diridon	30,900	340	2,000	3,700	5,900	2,300	12,300	4,300
Downtown Gilroy	12,400	2,100	0	2,200	2,800	2,000	2,300	1,050
East Gilroy	12,400	2,700	600	1,900	3,400	3,200	560	130

Source: Authority 2016b
HSR = high-speed rail
TNC = transportation network company
[1] Passenger trip generation values presented in this table are rounded as follows: values presented in the hundreds are rounded to the nearest ten; values presented in the thousands are rounded to the nearest hundred except where necessary to make sure that values for the row sum correctly.
[2] Includes boardings and alightings by HSR passengers.
[3] Mode of access refers to trips associated with boardings. Mode of egress refers to trips associated with alightings. For the traffic effects analysis, trips associated with potential privately operated off-site parking or rental car facilities are included as shuttle trips instead of individual vehicle trips.

Table 3.2-4 shows the average vehicle occupancy, or passengers per vehicle, for each mode of access at San Jose Diridon, Downtown Gilroy, and East Gilroy stations forecast in 2029 and 2040. Passenger trips associated with off-site parked cars and rental cars were included as shuttle trips at the station level.

Table 3.2-4 2029 and 2040 Passengers per Vehicle by Mode

Station	Passengers per Vehicle			
	Parked Car	Drop Off/ Pick Up	Rental Car	Taxi/TNC
San Jose Diridon	1.33	1.43	1.41	1.28
Downtown Gilroy	1.31	1.46	1.51	1.29
East Gilroy	1.31	1.46	1.51	1.29

Source: Authority 2016b
TNC = transportation network company

Table 3.2-5 shows the daily, AM peak hour, and PM peak hour vehicle trips generated by the San Jose Diridon, Downtown Gilroy, and East Gilroy stations forecast in 2029 and 2040. Parked car and taxi/transportation network company trips result in one vehicle trip per boarding or alighting while drop off/pick up trips from private cars result in two vehicle trips (one trip entering the site and another leaving the site) per boarding or alighting.

Table 3.2-5 2029 and 2040 Vehicle Trip Generation at High-Speed Rail Stations

Station	Daily Vehicle Trips	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
2029 Vehicle Trips							
San Jose Diridon[1]	3,720	210	190	400	190	210	400
Downtown Gilroy	2,000	230	130	360	130	230	360
East Gilroy	2,100	240	170	410	170	240	410
2040 Vehicle Trips							
San Jose Diridon[1]	10,100	540	520	1,100	520	540	1,100
Downtown Gilroy	5,200	400	290	690	290	400	690
East Gilroy	5,400	440	310	750	310	440	750

Source: Authority 2016b
HSR = high-speed rail
[1] Trips reflect the vehicles that drive to HSR station facilities. 36 daily employee round trips at San Jose Diridon Station and 29 daily employee round trips at the Downtown Gilroy or East Gilroy Station were included.

Transit Trip Generation at Stations

The Authority estimated station transit trips based on estimated passenger trips for transit access modes. The project would generate approximately 700 peak hour transit trips at San Jose Diridon Station, approximately 130 peak hour transit trips at the Downtown Gilroy Station, and approximately 30 peak hour trips at the East Gilroy Station in 2029. In 2040, the project would generate approximately 1,200 peak hour transit trips at San Jose Diridon Station, approximately 230 peak hour transit trips at the Downtown Gilroy Station, and approximately 50 peak hour trips at the East Gilroy Station.

Trip Generation at the Maintenance Facility Sites

The Authority calculated trip generation for the MOWF sites based on an estimated number of 150 employees at the proposed facility. The employees were classified based on their operational function as maintenance shop employees, management, crew and support, or maintenance-of-way employees. The MOWF vehicle trip generation was based on trip rates identified in the Institute of Transportation Engineers *Trip Generation Manual* for a general light industrial use[4] (Institute of Transportation Engineers 2012). The Authority assumed that full employment of 150 employees would be required by 2029 and 2040 (Authority 2016d). Vehicle trips are not anticipated at the maintenance of infrastructure siding (MOIS) near Turner Island Road. This facility would be accessed primarily by rail. Emergency vehicle access would be provided; however, worker or passenger vehicles would not typically access this facility on a daily basis.

Table 3.2-6 shows trip generation at the proposed MOWF locations forecast for 2029 and 2040. Both potential site alternatives would have identical employee estimates and classifications, and therefore would generate the same number of trips. The table shows that the facility would be expected to generate approximately 470 daily vehicle trips, with roughly 70 vehicle trips each during the AM and PM peak hours.

Table 3.2-6 2029 and 2040 Vehicle Trip Generation at Maintenance of Way Facilities

Station	Daily Trips	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
East Gilroy and South Gilroy MOWF	470	57	12	69	14	52	66

Source: Authority 201b6
MOWF = maintenance of way facility

Baseline Operations Analysis

Pursuant to CEQA requirements, an EIR must include a description of the existing physical environmental conditions near a project. Those conditions, in turn, "will normally constitute the baseline physical conditions by which a lead agency determines whether an impact is significant" (CEQA Guidelines § 15125(a)). Accordingly, this document analyzes the impacts from project construction as compared to the existing conditions in 2016.

Since this project would not commence operations for almost 10 years and would not reach full operations for almost 25 years, use of only existing conditions as a baseline for traffic LOS impacts from HSR operations would be misleading (the EIR/EIS assumes Phase 1 rail service would commence in 2029). Therefore, the LOS traffic analysis from HSR operations uses a multiple baseline approach. The Authority evaluated the project's LOS traffic impacts against both existing conditions and background (i.e., No Project) conditions forecast for 2029 and 2040. More detail is provided in the Transportation Technical Report (Authority 2019a).

The Authority evaluated the following six scenarios:

- **Existing conditions**—Reflects current transportation conditions based on current counts and facilities.
- **Existing Plus Project conditions**—Evaluates the potential impacts of the physical alterations proposed by the project. All transportation network modifications necessary to construct the project (e.g., roadway closures, roadway modifications) are reflected in this scenario. The project would not provide rail service under existing conditions, so ridership at stations is not reflected under this scenario.

[4] ITE land use code 110. Light industrial uses have a higher trip-generation rate than heavy industrial uses (ITE code 120), so use of this code represents a conservative assumption.

- **2029 No Project conditions**—Reflects future transportation conditions in 2029, including reasonably foreseeable land use changes and transportation network modifications.
- **2029 Plus Project conditions**—Evaluates the potential impacts of the project on 2029 baseline conditions with project ridership anticipated in 2029. All transportation network modifications necessary to construct the project along with HSR service and ridership at stations are reflected in this scenario.
- **2040 No Project conditions**—Reflects future transportation conditions in 2040, including reasonably foreseeable land use changes and transportation network modifications.
- **2040 Plus Project conditions**—Evaluates the full potential impacts of the project on 2040 baseline conditions. All transportation network modifications necessary to construct the project along with HSR service and ridership at stations are reflected in this analysis scenario.

Construction and operations activities were both analyzed as part of the LOS impact analysis for the 2029 and 2040 Plus Project conditions. Because temporary street closures and relocations would occur during the construction phase, these construction impacts are described quantitatively for the Existing Plus Project conditions and qualitatively for the 2029 and 2040 Plus Project conditions. The combined impacts from construction and operations are described quantitatively for the 2029 and 2040 Plus Project conditions.

Roadways, Freeways, and Intersections Analysis

This section describes transportation operating conditions in terms of LOS and delay. LOS is the primary unit of measure for stating the operational quality of a roadway or intersection and is qualitative, with a ranking system of A through F, where LOS A signifies the best and LOS F the worst operating conditions. The Authority followed the procedures in the *Highway Capacity Manual* (Transportation Research Board 2010) to calculate the LOS.

As discussed in Section 3.2.2.2, California is no longer using automobile delay as a measure of transportation impacts under CEQA. The LOS consequences caused by the project may nevertheless be relevant for consideration of other transportation-related environmental effects, including impacts on transit and nonmotorized travel, emergency vehicle access, air quality and GHG, and noise. The LOS consequences are therefore presented in the transportation section and referenced in other parts of the EIR/EIS where appropriate.

LOS criteria for identifying effects on signalized intersections, unsignalized intersections, and freeways under NEPA are described in the following subsections.

Roadways

The Authority evaluated changes to roadways qualitatively by assessing the construction and operations impacts on intersections in the RSA. Intersections represent the governing factors establishing the capacity of the roadway transportation network; thus, the analysis focuses on these key locations. The Authority assessed whether project changes to infrastructure or circulation would temporarily or permanently affect vehicle circulation, disrupt transportation system operations, or damage the roadway system.

Freeways

The Authority evaluated freeway mainline segments using the method described in Chapter 11 of *Highway Capacity Manual* (Transportation Research Board 2010). This method takes into consideration peak hour traffic volumes, free-flow speeds, percentage of heavy vehicles, and number of travel lanes. These factors are used to determine the vehicle density, measured in passenger cars per mile per lane. Table 3.2-7 shows the relationship between freeway density and LOS. Freeway segments that would serve 100 or more project-generated vehicle trips in either peak hour were evaluated.

Table 3.2-7 Freeway Level of Service Definitions

Level of Service	Volume to Capacity Ratio
A	< 0.283
B	0.283 to 0.457
C	0.457 to 0.673
D	0.673 to 0.849
E	0.849 to 1.0
F	> 1.0

Source: Transportation Research Board 2010
< = less than
> = greater than

The Authority identified impacts on the freeway system through a two-step process. First, the LOS was determined using the traffic density, as shown in Table 3.2-7. Then, for freeway segments with LOS E or F (only), the difference in the V/C ratio between the No Project conditions and Plus Project conditions was calculated. An adverse effect under NEPA was deemed to occur if the project would cause the V/C ratio to increase by 0.04 (4 percent) or more.

Intersections

The operation of signalized intersections is based on various intersection characteristics, such as traffic volumes, lane geometry, and signal phasing, to estimate the average control delay experienced by motorists traveling through an intersection. Control delay incorporates delay associated with deceleration, acceleration, stopping, and moving up in the queue. Table 3.2-8 shows the relationship between average delay per vehicle and LOS for signalized intersections.

Table 3.2-8 Signalized Intersection Level of Service Definitions

Level of Service	Description	Average Control Delay Per Vehicle (seconds)
A	Operations with very low delay occurring with favorable progression and/or short cycle lengths.	≤ 10
B	Operations with low delay occurring with good progression and/or short cycle lengths.	10.1 – 20
C	Operations with average delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures begin to appear.	20.1 – 35.0
D	Operations with longer delays due to a combination of unfavorable progression, long cycle lengths, and high V/C ratios. Many vehicles stop and individual cycle failures are noticeable.	35.1 – 55.0
E	Operations with high delay values indicating poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	55.1 – 80
F	Operations with delays unacceptable to most drivers occurring due to oversaturation, poor progression, or very long cycle lengths.	> 80

Source: Authority 2019a
< = less than or equal to
> = greater than
V/C = volume to capacity

The Authority evaluated traffic conditions at unsignalized intersections using the method from Chapter 19 of the *Highway Capacity Manual* (Transportation Research Board 2010). With this method, operations are defined by the average control delay per vehicle (measured in seconds) for each movement that must yield to the right-of-way. At two-way or side street–controlled intersections, analysts calculated the control delay (and LOS) for each controlled movement, as well as the left-turn movement from the major street, and the entire intersection. For controlled approaches composed of a single lane, the control delay is the average of all movements in that lane. The delays for the entire intersection and for the movement or approach with the highest delay are reported. Table 3.2-9 shows the relationship between delay and LOS for unsignalized intersections.

The Authority determined LOS values for the study intersections based on *Highway Capacity Manual* procedures using Synchro, SimTraffic, or VISSIM software packages depending on the individual intersection configuration and operating characteristics. Synchro was used to analyze intersections with standard configurations and operating characteristics that are not close to other major intersections. The SimTraffic microsimulation package was used to evaluate intersections at freeway interchanges. The VISSIM microsimulation package was applied at intersections where high levels of congestion, frequent transit service, adjacent rail crossings, high pedestrian or bicycle volumes, or special traffic signal systems (such as transit signal priority) warranted a more complex analytical approach.

Table 3.2-9 Unsignalized Intersection Level of Service Definitions

Level of Service	Description	Average Control Delay Per Vehicle on Worst Approach (seconds)
A	Little or no delays	≤ 10.0
B	Short traffic delays	> 10.0 to 15.0
C	Average traffic delays	> 15.0 to 25.0
D	Long traffic delays	> 25.0 to 35.0
E	Very long traffic delays	> 35.0 to 50.0
F	Extreme traffic, delays where intersection capacity exceeded	> 50.0

Source: Transportation Research Board 2010
< = less than or equal to
> = greater than

The intersection analysis for Alternative 4 follows the methods and analysis precedent set by recent analysis of intersections near passenger rail grade crossings in the Bay Area. The VISSIM microsimulation software analysis package was used to analyze the roadway networks; the VISSIM software allows for the direct coding of traffic signal preemption during train grade crossing events. Existing conditions models were built and validated based on traffic counts, aerial intersection geometry information, and field-observed traffic conditions. The 2029 and 2040 No Project train schedules were taken from existing published information from Caltrain. Trains schedules for Alternative 4 under 2029 and 2040 Plus Project conditions were provided by the Authority and include 12 peak direction trains (combined for HSR and Caltrain) and eight off-peak direction trains (all HSR) per hour. Gate down times were estimated using data from the San Francisco to San Jose segment of the corridor; the 95th percentile single-train gate down times (54 seconds for intersections away from HSR stations, and 68 seconds for intersections near HSR stations) provided a conservative basis for the analysis of project effects on intersection operations. The simulation models used the train schedule as an input to compute the effects of 2-for-1 grade crossing events (where two trains in opposite directions pass each other at a grade crossing, thus extending the time the gates are down and the traffic signal is preempted from normal operation).

In addition, analysts conducted a focused analysis of conditions during project construction in the Monterey Corridor Subsection. This focused analysis evaluated the effects of narrowing the facility to four lanes with the elimination of turn lanes on Monterey Road for the duration of construction.[5]

Parking Analysis

The focus of the parking analysis is on the HSR stations and the effects on parking of project construction and operations at and adjacent to the stations as such effects relate to the potential for secondary physical impacts on the environment and socioeconomic conditions. Existing parking was identified by review of aerial photography and public websites.

Transit Analysis

The Authority evaluated transit facilities and operations, including bus and rail transit services, by reviewing the effect of project footprint plans, passenger trip generation estimates, and intersection LOS on transit in the project footprint. The Authority obtained data for existing and future transit services from on-site reviews of existing facilities, from reviews of publicly available information and plans, and by contacting the various service providers (e.g., VTA, Caltrain).

The Authority evaluated project construction impacts on passenger rail service by identifying the temporary closures of passenger rail track that would likely disrupt service. Analysts used the HSR Statewide Travel Demand Model (Caltrans 2018) to assess potential changes in Caltrain and other transit ridership because of project operations (Authority 2016a, 2017b).

Nonmotorized Travel Analysis

The Authority evaluated nonmotorized transportation facilities, including bicycle and pedestrian facilities, by reviewing engineering plans and project footprints and passenger trip generation estimates. Specifically, analysts evaluated impacts of the project designs on nonmotorized transportation in the project footprint and the impact of project-related trips on nonmotorized transportation in the project footprint and RSA. Analysts obtained data for existing and future nonmotorized facilities from on-site reviews of existing facilities, review of publicly available information and plans, and contacting the various jurisdictions (e.g., City of San Jose, Caltrans).

Freight Rail Service

The Authority evaluated construction impacts on freight rail service qualitatively by identifying where project construction would disrupt freight service and how long such disruptions would last. Analysts evaluated the operations impacts on freight service where the project would share passenger and freight rails based on potential changes in freight service access, routing, and operating hours due to the sharing of tracks north of the Santa Clara Station.

Aviation

Section 3.11, Safety and Security, reviews airport master plans and potential construction and operational safety impacts on public and private airports within 2 miles of the project and concludes that the project would be consistent with airport master plans, would conform to airspace safety requirements, and would not have an impact on aviation safety. That analysis is not repeated in this section.

There are four public airports within 2 miles of the project section: Norman Y. Mineta San Jose International Airport (0.3 mile from the nearest portion of the project footprint near Interstate (I-) 880 in San Jose), San Martin Airport (0.5–0.6 mile from the project footprint), Frazier Lake Airpark

[5] LOS analysis is done primarily for traffic in the RSA that would be affected by project operations once the project commences operation (including permanent roadway reconfigurations commencing with construction). Traffic congestion from project construction would largely be temporary, so an LOS analysis would not be appropriate. However, an LOS analysis was prepared to evaluate the potential effects of the narrowing of Monterey Road to four lanes with the elimination of left-turning movements during construction. Effects from project construction in other areas pertain to maintaining safety and access during construction.

(0.3–0.8 mile from the project footprint) and the Los Banos Municipal Airport (2.0 miles from the project footprint).

Operations of the overall HSR system would be expected to result in some changes in the demand for air travel on a statewide and regional basis. The San Jose International Airport, which is the only airport near the project providing regular commercial aviation service, is located approximately 4 miles (via road) from the San Jose Diridon Station. The airport serves the San Francisco Bay Area, and would be expected to experience a reduction in demand as a result of the project. Demand for some trips otherwise expected to be made by air would be made using HSR instead. Based on modeling for the 2040 period under the high ridership scenario, the HSR system overall is expected to reduce airline flights by 26 percent statewide and 31 percent in the Bay Area compared to the no project scenario. As explained in the 2005 *Program Environmental EIR/EIS for the Proposed California High-Speed Train System* (Authority and FRA 2005), airports in the Los Angeles area and the San Francisco Bay Area are constrained in terms of runway and terminal capacity; without the HSR system, there would be a need for expansion of major airports. Consequently, the reduction in air travel demand would allow for better management of the limited capacity of existing airports as well as reduce the demand for construction of additional runways and terminals.

The HSR system would also provide more convenient access to airports for some travelers in general and to San Jose International Airport in particular. This improved access could increase demand for air travel in some cases.

While the HSR system would change air travel demand on a statewide and regional basis, it would also provide more convenient access to airports. The project alternatives would not conflict with adopted aviation programs or otherwise decrease the performance or safety of aviation facilities and would allow for better management of existing constrained airport facilities.

Since the project would not have an adverse effect on aviation facilities or operations, the operational effects on aviation are not reviewed further in this section.

3.2.4.4 Method for Evaluating Impacts under NEPA

CEQ NEPA regulations (40 Code of Federal Regulations Parts 1500–1508) provide the basis for evaluating project effects (as described in Section 3.1.6.4). As described in Section 1508.27 of these regulations, the criteria of context and intensity are considered together when determining the severity of the change introduced by the project.

- For the transportation analysis, the *context* would include adopted local plans, policies, and regulations; existing and planned transportation systems; and the relative sensitivity of transportation conditions to construction or operational changes.
- For the analysis of transportation effects, *intensity* is determined by assessing the degree to which the proposed project would result in changes to transportation-related conditions; and inconsistency with regional and local transportation plans.

In addition, the Authority identified criteria to be used for the identification of adverse NEPA effects in evaluating construction-related and operations-related effects on the roadway network as follows:

- For freeway segments, if the Plus Project conditions would have an LOS of E or F and the project would result in an increase in V/C ratio of 0.04 (4 percent increase) or more over the baseline condition (V/C=1.00 is equivalent to a facility operating at capacity).
- For signalized intersections, if the Plus Project conditions would have an LOS E or F and the project would result in an increase in average traffic delay of 4 seconds or more over the baseline condition.
- For unsignalized intersections, if the Plus Project conditions would have an LOS E or F and the project would result in an increase in traffic delay of 5 seconds or more (measured as average delay for all-way stop or worst-movement delay for side-street stop intersection), and

if the intersection satisfies one or more traffic signal warrants for at least 1 hour of the day. Five seconds of delay is the criteria increase for unsignalized intersections (rather than the 4 seconds used for signalized intersections) because it only applies to a single movement.

3.2.4.5 Method for Determining Significance under CEQA

The following subsections list the significance thresholds for roadways, freeways, intersections (vehicle circulation); parking; transit; nonmotorized transportation; and freight rail service.

Roadways, Freeways, and Intersections (Vehicle Circulation)

Under CEQA Guidelines Section 15064.3, automobile delay no longer constitutes a significant environmental impact. Accordingly, this analysis does not characterize a particular level of automobile delay on roadways, freeways, and intersections as a significant environmental impact.

Operations-caused effects on the roadway network would be significant if they would result in a net increase in VMT over baseline conditions, or otherwise conflict with CEQA Guidelines Section 15064.3, subdivision (b).

Parking

Parking conditions evolve over time as people alter their modes and patterns of travel in response to changing land uses and transportation options. Pursuant to SB 743, the adequacy of parking for a project shall not support a finding of significance. However, parking losses caused by a project or parking demand generated by a project in excess of the parking supply provided by the project could result in a significant indirect (secondary) impact on the environment if the insufficiency of parking results in secondary impacts such as on VMT, air quality, noise, safety, or land use.[6] The criteria for the evaluation of these potential secondary impacts are the same as those used for direct (primary) impacts. The VMT criterion is the same as that described for vehicle circulation. For other relevant criteria, see Section 3.3, Air Quality and Greenhouse Gases; Section 3.4, Noise and Vibration; Section 3.11, Safety and Security; and Section 3.13, Station Planning, Land Use, and Development.

Transit

The project would have a significant impact if it would conflict with a program, plan, ordinance, or policy regarding public transit, or otherwise materially decrease the performance of such facilities.

Nonmotorized Transportation

The project would have a significant impact if it would conflict with a program, plan, ordinance, or policy regarding bicycle or pedestrian facilities, or otherwise materially decrease the performance of such facilities.

Freight Rail Service

The project would have a significant impact if it would substantially disrupt or interfere with freight operations or require greater temporal separation that would change freight rail service such that resultant diversions to truck or other freight modes would result in significant secondary impacts related to air quality, noise, GHG emissions, or traffic operations (as defined by the other applicable significance criteria in this Final EIR/EIS).

3.2.5 Affected Environment

Existing and planned transportation conditions in the transportation RSAs are described in this section by condition, from north to south by subsection, and, where applicable, by facility. This information provides the context for the environmental analysis and evaluation of impacts.

[6] Socioeconomic effects of insufficient parking supply are not considered impacts under CEQA. However, potential socioeconomic effects due to insufficient parking supply are analyzed as NEPA effects in this section.

3.2.5.1 Vehicle Miles Traveled

The Authority used the statewide travel demand model to estimate VMT (2016) in the RSA for medium and high scenarios. In 2015, Santa Clara County estimated total VMT[7] ranged between 10.283 and 10.312 billion miles, estimated interregional VMT[8] in San Benito County ranged between 613 and 620 million miles, and estimated interregional VMT in Merced County ranged between 1.217 and 1.239 billion miles.

3.2.5.2 Roadways, Freeways, and Intersections

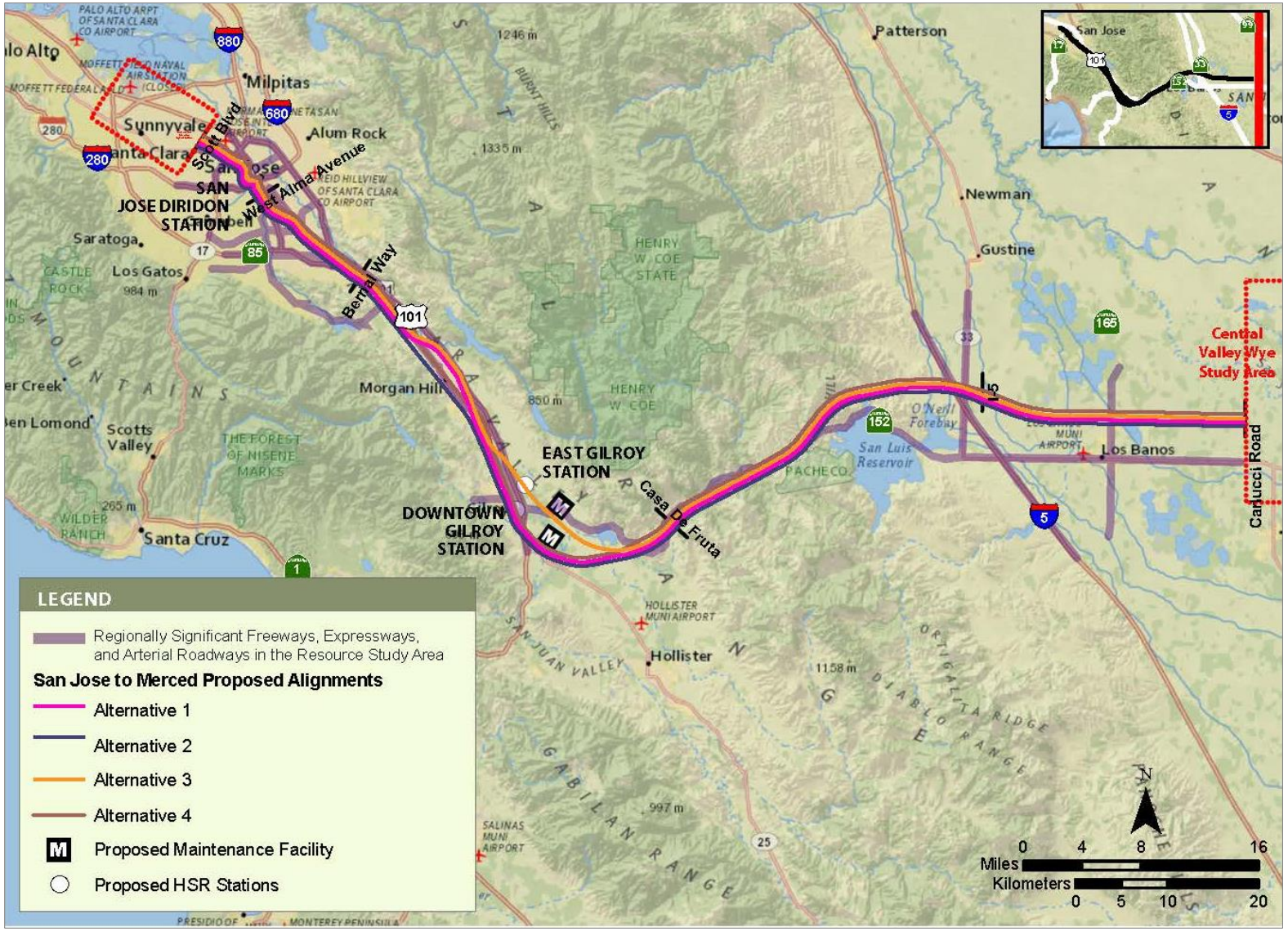
The RSA contains several regionally significant routes that serve as connections between population centers and transit hubs along the corridor. San Jose is served by a network of expressways, freeways, and arterial roadways, while Morgan Hill, Gilroy, and other jurisdictions south of San Jose are served primarily by U.S. Highway (US) 101 and Monterey Road. Pacheco Pass is a rural area, with State Route (SR) 152 crossing the subsection as a connection between Gilroy and Merced County. The San Joaquin Valley Subsection is served by I-5, SR 33, and SR 165. SR 33 provides a connection to I-5, SR 165, and SR 152. These routes each serve trucks, including freight service vehicles, which experience the same levels of service and congestion as the general traveling public. Figure 3.2-1 illustrates regionally significant routes.

The Authority selected 20 freeway segments along US 101 for study based on the fact that the project would add 100 vehicle trips or more to these segments during either the AM or PM peak hour, or both. The Authority studied intersections along other regionally significant routes, such as Monterey Road, SR 152, and SR 165, but quantitative segment analysis was not included for any segments other than US 101 because these segments would have fewer than 100 vehicle trips during the AM or PM peak hour.

Under existing conditions, five segments operate at LOS E or F. In the AM peak hour, the northbound direction of travel is more congested around the Monterey Corridor Subsection in San Jose. In the PM peak hour, the southbound direction is congested in the same area. In Gilroy, the same pattern exists. Table 1 of Appendix 3.2-A, Transportation Data on Roadways, Freeways, and Intersections, in Volume 2 provides existing volumes, V/C ratios, and LOS for the evaluated freeway segments. The locations of freeway segments are illustrated on Figure 3.2-2 and Figure 3.2-3.

[7] "Total VMT" includes all vehicle miles traveled within the designated geography, including local VMT. In Santa Clara County, the project includes stations in San Jose Diridon and Gilroy, and thus the project would affect local as well as regional travel.

[8] "Interregional VMT" includes vehicle miles traveled associated with travel between regions but does not include local VMT. This project section does not include stations in San Benito County or Merced County, so the project's effect on VMT would be on regional trips.



Source: Authority 2019a

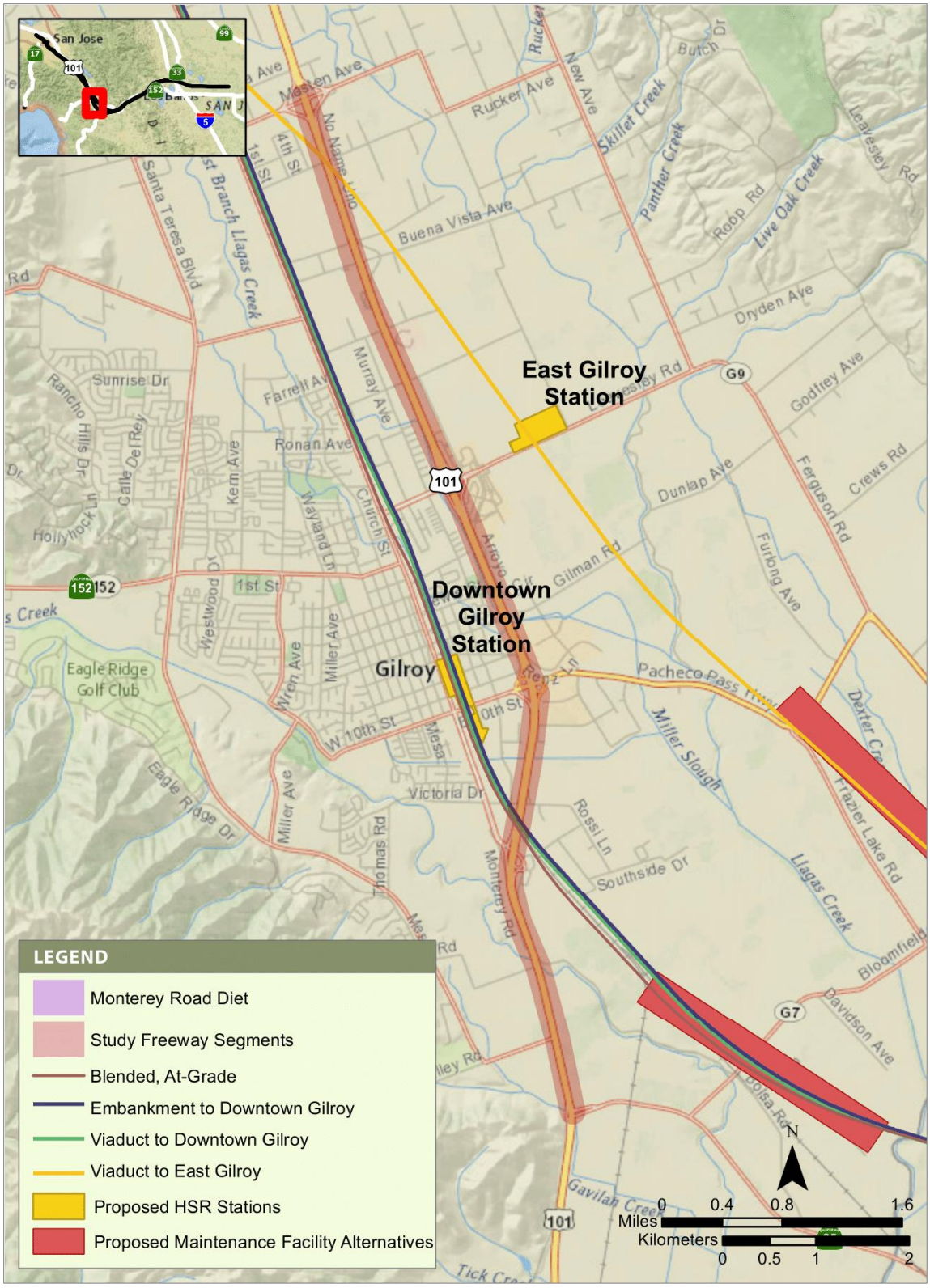
MARCH 2019

Figure 3.2-1 Regionally Significant Freeways, Expressways, and Arterial Roadways

Source: Authority 2019a

MARCH 2019

Figure 3.2-2 Monterey Corridor Freeway Segments



Source: Authority 2019a MARCH 2019

Figure 3.2-3 Gilroy Freeway Segments

San Jose Diridon Station Approach Subsection

San Jose Diridon Station is located at 66 Cahill Street, approximately 0.5 mile west of downtown San Jose. Vehicle access directly around San Jose Diridon Station is provided primarily via Cahill Street, Montgomery Street, and Stover/Crandall Street. Cahill Street provides access to the surface parking lots in the northern portion of the site and the primary passenger loading location directly in front of the station. It also accommodates buses entering the bus terminal. Montgomery Street provides access to the surface parking lots, and vehicles using Montgomery Street to access the passenger loading area use the Stover Street approach. Limited parking and passenger loading is available on the west side of the station on Laurel Grove Lane.

Freeway access to San Jose Diridon Station is provided via six nearby interchanges: I-280/Bird Avenue, SR 87 (Guadalupe Parkway)/West Julian Street–East St. James Street, SR 87 (Guadalupe Parkway)/West Santa Clara Street, SR 87 (Guadalupe Parkway)/Park Avenue, I-880/The Alameda, and I-880/Coleman Avenue. The local streets used by vehicles to access the station area are West Santa Clara Street from the north; Park Avenue, South Montgomery Street, and Autumn Street from the south; and from the east West San Fernando Street provides access to parking and loading areas. Vehicles primarily access Cahill Street and South Montgomery Street via West Santa Clara Street.

Passenger loading occurs at a loop driveway immediately east of the station entrance. Access to this loading area is via Cahill Street or Stover Street. This drive provides approximately 180 feet of loading space, including one 20-foot dedicated Americans with Disabilities Act–compliant loading space. This area can accommodate around eight vehicles, with overflow loading often occurring on Stover Street or Crandall Street.

There are 581 parking spaces spread among several adjacent surface parking lots operated by Caltrain. Several additional nearby private surface parking lots are available to Caltrain riders as well. Daily parking at Caltrain-operated facilities costs $5.50 per vehicle. Rates at privately operated lots vary.

The Authority studied 50 intersections around the San Jose Diridon Station. All study intersections in the station vicinity operate at LOS D or better under existing conditions during weekday AM and PM peak hours. Volume 2, Appendix 3.2-A, Table 7, provides information on the existing signal control, delay, and LOS at the San Jose Diridon Station Approach Subsection intersections.

Section 3.2.5.3, Diridon Station and SAP Center Parking, discusses the circumstances regarding special event parking at the SAP Center adjacent to the San Jose Diridon Station.

Monterey Corridor Subsection

Monterey Road is a four-to-six-lane arterial running parallel to US 101 and Hale Avenue/Santa Teresa Boulevard. It provides a primary north-south connection for the central and southern portions of San Jose, Coyote Valley, Morgan Hill, San Martin, and Gilroy.

Unlike other facilities studied, the area surrounding Monterey Road has a limited number of parallel routes. Most north-south trips, both local and pass-through, between south San Jose and Gilroy travel on US 101 or Monterey Road. During peak hours, there is high demand on the two facilities. US 101 is a freeway and, when not congested, offers the fastest route for vehicles. Monterey Road is the second fastest route, providing direct access to neighborhood and local streets. Hale Avenue/Santa Teresa Boulevard provides a third, less-direct route, but it has the lowest free flow speed and ends in Morgan Hill. Therefore, most local and pass-through traffic in the Monterey Corridor Subsection is forced to use Monterey Road or US 101 for north-south trips that cannot be easily dispersed onto adjacent facilities.

The Authority studied 46 intersections in and around the Monterey Corridor. Eight intersections in the AM peak hour and seven intersections in the PM peak hour operate at LOS E or F under existing conditions. Monterey Road and US 101 serve high demand in the peak hours. Demand is generally higher in the northbound direction in the AM peak hour and higher in the southbound direction in the PM peak hour. Traffic volumes on both roadways approach or exceed their capacities in the peak hours. When traffic volumes on roadways approach or exceed the capacity,

delays develop at the intersections along the roadway. High peak hour demand results in congestion at key intersections along Monterey Road. Volume 2, Appendix 3.2-A, Table 8, shows the existing signal control, delay, and LOS at the Monterey Corridor Subsection intersections.

Morgan Hill and Gilroy Subsection

The historic Downtown Gilroy Station at 7150 Monterey Street serves as the main transit hub for the city, providing Caltrain service. Vehicles access the station and surface parking lots via Monterey Road, Old Gilroy Street, West 8th Street, or West 10th Street. Freeway access to the Downtown Gilroy Station is provided via the US 101/East 10th Street interchange. The primary vehicle entrance to the station at Monterey Road and West 8th Street is signal-controlled and provides direct access to the surface parking lot and passenger loading area. Passenger loading occurs in front of the station entrance on the west side. Bus-only loading bays are immediately adjacent to the station, while vehicular passenger loading takes place west of the bus bays. Five 30-minute perpendicular parking spaces are provided for passenger loading. There are approximately 471 parking spaces spread among several surface parking lots on the west side of the station. The existing roadway facilities adjacent to the station area serve the Downtown Gilroy Station and local residential and school traffic, as well as Gilroy's downtown retail and commercial centers on Monterey Road and 10th Street.

The East Gilroy Station would be located at Leavesley Road and Marcella Avenue, approximately 0.5 mile east of US 101. Near US 101, Leavesley Road is a six-lane arterial serving retail uses; adjacent to the station, it is a two-lane rural road serving agricultural uses.

There are two alternatives for MOWF facilities near Gilroy. The East Gilroy MOWF would be accessed from SR 152, near the intersection of SR 152 and Frazier Lake Road. SR 152 serves as an east-west expressway connection between downtown Gilroy, agricultural uses to the east, and the San Joaquin Valley. The South Gilroy MOWF would be accessed from Bloomfield Avenue, near the intersection of Bolsa Road. Bloomfield Avenue is a two-lane road with no shoulder, providing access to agricultural uses between SR 25 and SR 152.

The Authority studied 101 intersections in and around Morgan Hill and at the alternate sites for the Gilroy station and the MOWF. Four intersections operate at LOS E or F under existing conditions. Study intersections were chosen based on facility type, proximity to the station area, and major intersections that are likely to be affected by the change in traffic conditions because of the proposed HSR station or maintenance facility. Volume 2, Appendix 3.2-A, Table 9, shows the existing signal control, delay, and LOS at intersections in the Morgan Hill and Gilroy Subsection.

Pacheco Pass Subsection

SR 152 continues east of Gilroy as an east-west expressway. The roadway serves as the primary facility through Pacheco Pass and connects Gilroy to the San Joaquin Valley. The roadway serves Pacheco State Park and the San Luis Reservoir, as well as a large expanse of protected land. Because most of Pacheco Pass is undeveloped, SR 152 connects chiefly to private roads, access roads, and trails.

The Authority did not study any roadway segments or intersections in this subsection. Although the project would run parallel to SR 152, no major physical changes to the roadway network are currently planned. Furthermore, trips related to the project are not expected to meet or exceed the 50 peak hour trip threshold for study.

San Joaquin Valley Subsection

Henry Miller Avenue serves as an east-west collector parallel to SR 33 north of Los Banos. It intersects with SR 165 just north of Los Banos and primarily serves agricultural and very low-density residential land uses.

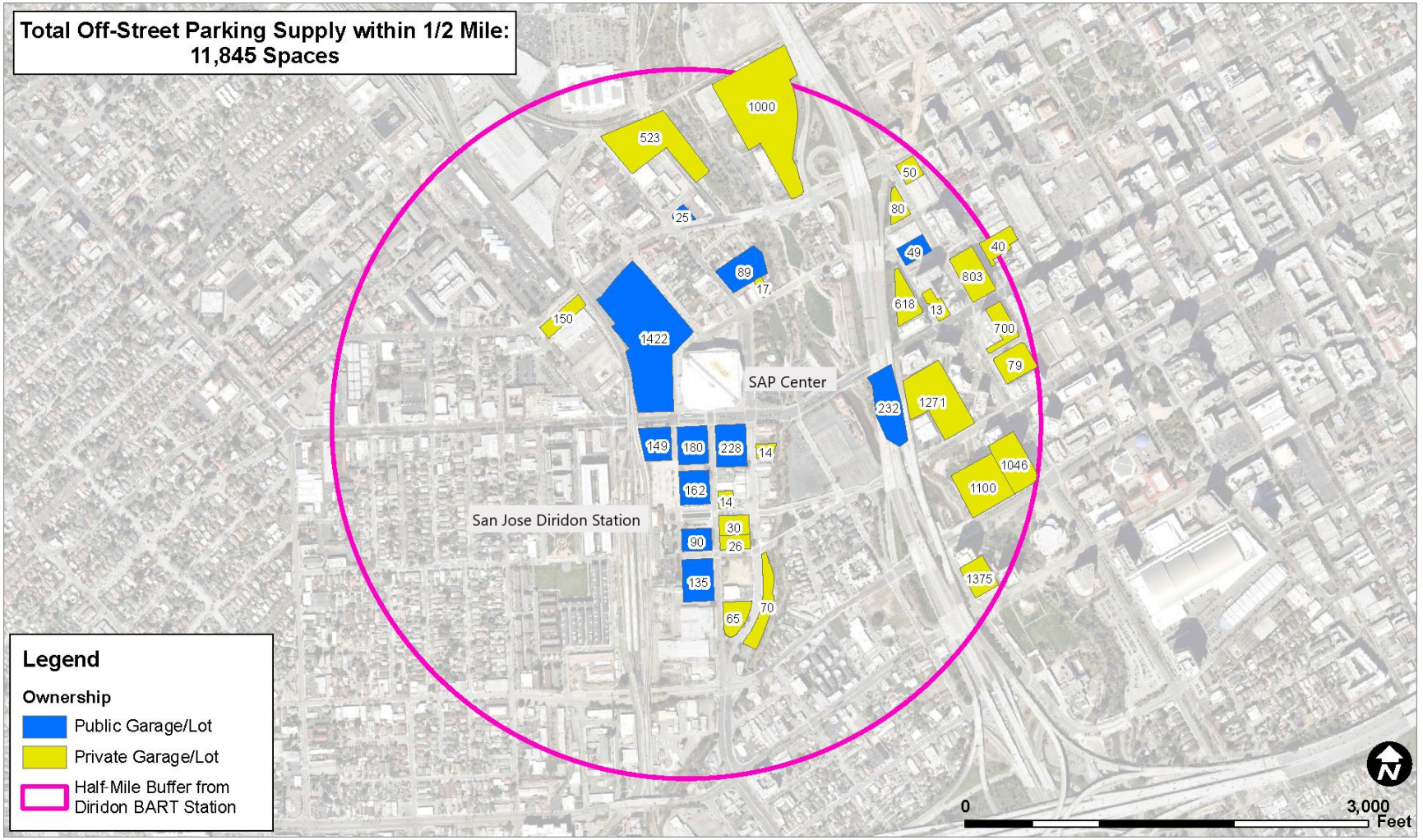
The Authority studied one intersection on Henry Miller Road at SR 165. The intersection currently operates at LOS B. The project would rebuild Henry Miller Road and reconfigure some of its intersections. The existing capacity would remain unchanged, and access to all parcels would be maintained. Count data were collected at intersections and roadway segments on Henry Miller

Road. The peak hour and daily volumes on Henry Miller Road are low, with fewer than 100 peak hour trips traveling through most intersections along the corridor, and few to no project trips are expected to travel on this corridor. Volume 2, Appendix 3.2-A, Table 10, includes the existing signal control, delay, and LOS at this San Joaquin Valley Subsection intersection.

3.2.5.3 San Jose Diridon Station and SAP Center Parking

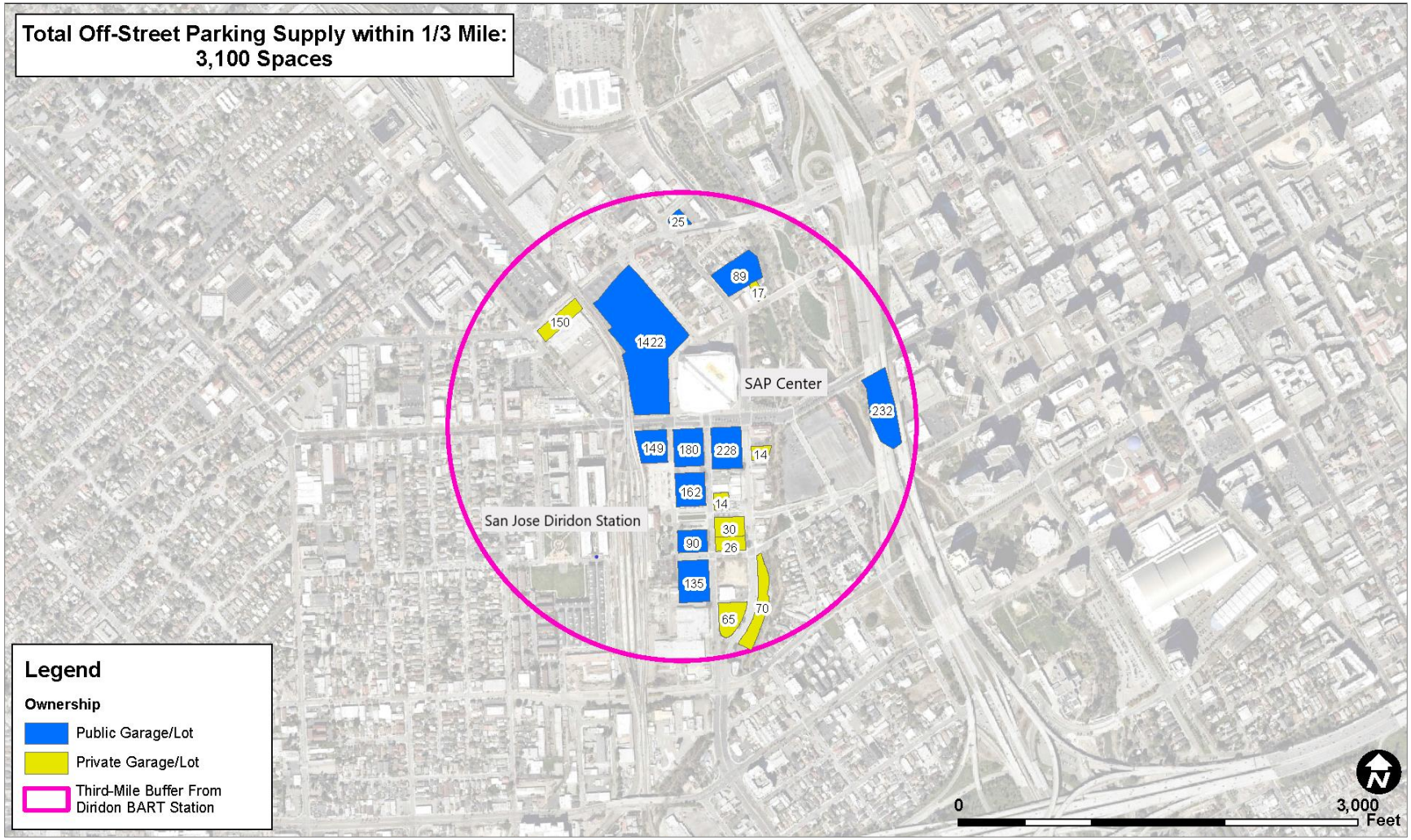
According to the *Diridon Station Area Plan* (DSAP), the City of San Jose is responsible for providing and maintaining the City's public parking facilities and on-street parking) (City of San Jose 2014b). The City is responsible for developing and implementing parking policies within the station area and citywide. The DSAP vision for the Diridon Station area is to develop a plan "around the transit station that anticipates maximum possible build-out of new transit-related development, supports transit ridership and economic development, and creates a world-class cultural destination." Regarding parking, the DSAP seeks to "ensure the continued vitality of the San Jose Arena as a major anchor for both the Downtown and the station area, and that sufficient parking and access for Arena customers is critical to the Arena's on-going success." To that end, the DSAP has a specific goal to "disperse parking in different locations in the planning area and beyond to ensure easy walking access to destinations." Per the DSAP, for event parking during weekday evenings, from 5:00 to 8:00 p.m., the average utilization of on-street parking is 85 percent and off-street parking is 87 percent.

VTA prepared a San Jose Diridon Station area parking inventory in 2017 to validate the number of available parking spaces in the station vicinity (VTA and FTA 2018: pages 5-104–5-107). The parking inventory identified approximately 14,450 publicly available parking spaces within 0.5 mile of San Jose Diridon Station: 2,605 on-street and 11,845 off-street spaces on both private and public property. Within 0.33 mile of the station, there are a total of approximately 4,145 parking spaces available to the public: 1,045 on-street and 3,100 off-street spaces. Figure 3.2-4a through Figure 3.2-4d shows these parking space locations. The BART Phase II extension will permanently displace 715 of these parking spaces, leaving a total of 3,430 spaces within 0.33 mile and 13,695 spaces within 0.5 mile of San Jose Diridon Station.



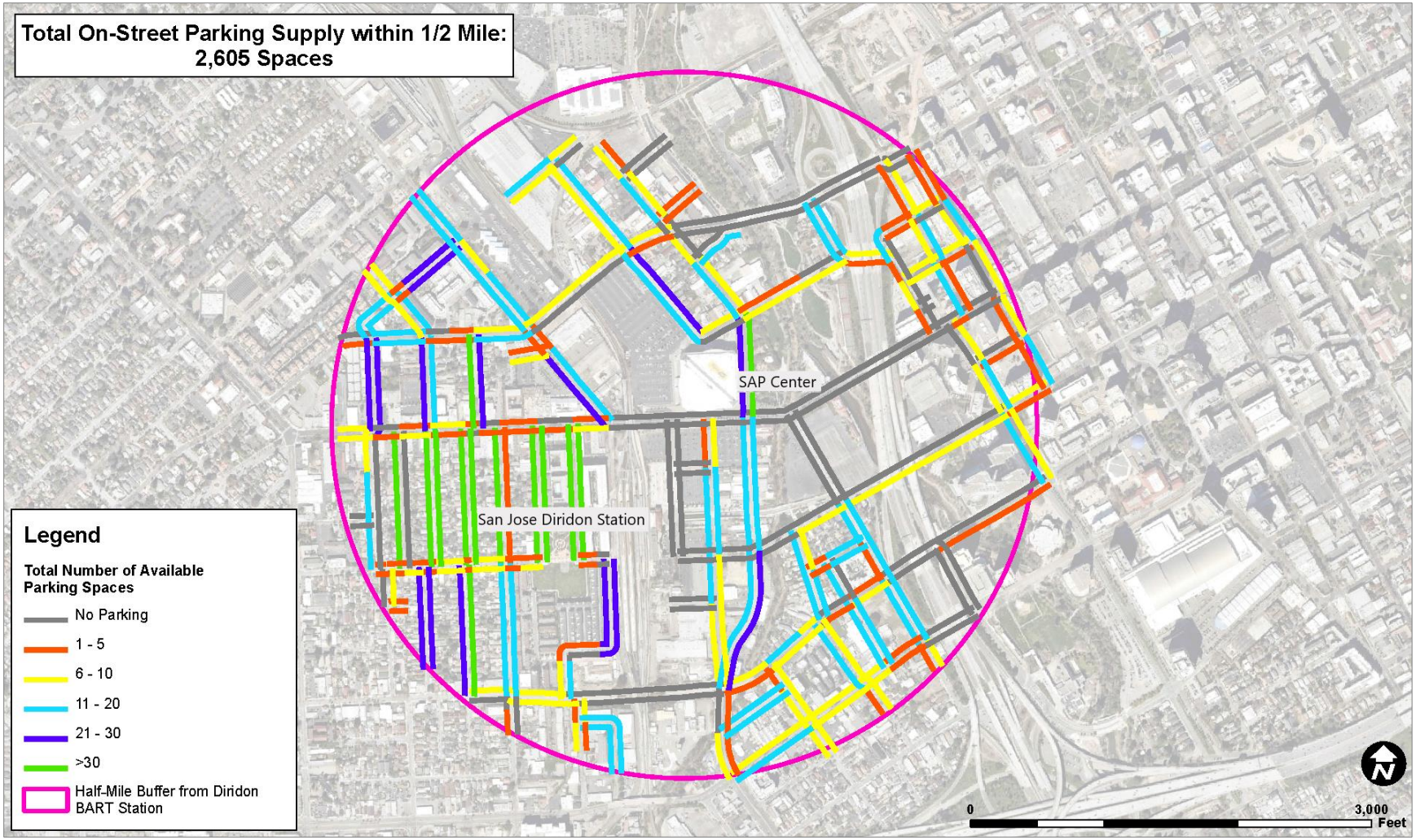
Source: VTA and FTA 2018

Figure 3.2-4a Parking near San Jose Diridon Station and SAP Center (Off-Street within 1/2 mile)



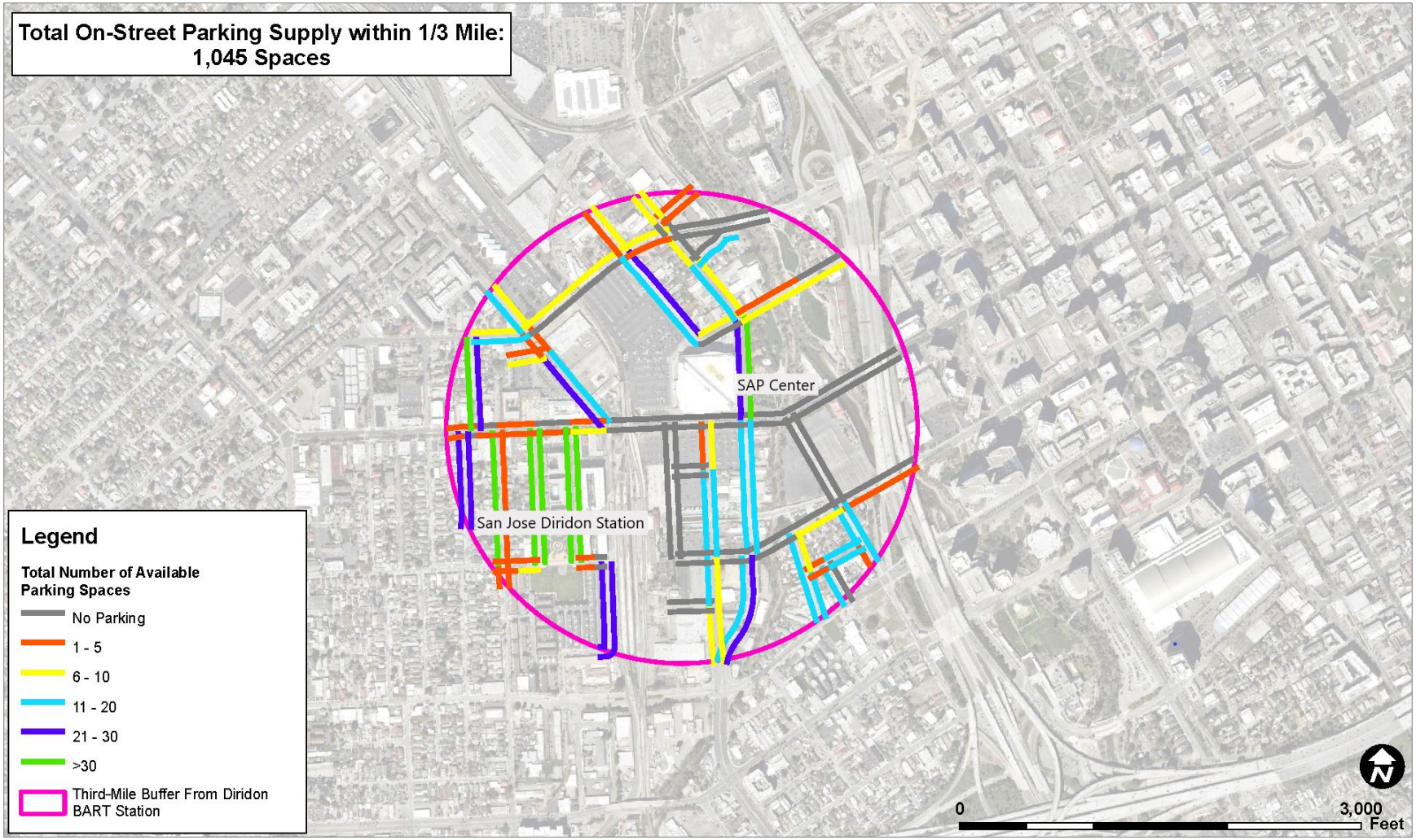
Source: VTA and FTA 2018

Figure 3.2-4b Parking near San Jose Diridon Station and SAP Center (Off-Street within 1/3 mile)



Source: VTA and FTA 2018

Figure 3.2-4c Parking near San Jose Diridon Station and SAP Center (On-Street within 1/2 mile)



Source: VTA and FTA 2018

Figure 3.2-4**d Parking near San Jose Diridon Station and SAP Center (On-Street within 1/3 mile)**

There are also 4,798 public parking spaces (in nine lots, each open 24 hours/day) as well as private parking lots between 0.5 mile and 1 mile from San Jose Diridon Station in downtown San Jose, as well as additional public parking lots between 1 mile and 1.5 mile from the station (Park San Jose 2019).

Per the BestParking website, which provides real-time parking availability and pricing for the downtown San Jose area (including the San Jose Diridon Station area), 39 garages were counted within 1 mile east of the station, with weekday parking costs ranging from $6 to $45/day and an average parking cost of $17.50. Norman Y. Mineta San Jose International Airport parking cost is $22/day and $15/day for the economy lot, with approximately 4,407 spaces in two garages and four lots. The HSR Business Plan assumes market-provided parking up to $32/day for San Jose Diridon Station and within an average 10-minute walking distance of the station, more than the average daily cost in downtown San Jose or at the San Jose International Airport.

According to the Arena Management Agreement between the City of San Jose and San Jose Arena Management, the City is contractually obligated to provide at least 6,350 off-site parking spaces within 0.5 mile of the SAP Center. Of the 6,350 off-site parking spaces, 3,175 must be within 0.33 mile of the SAP Center.

There is a separate Cooperative Parking Agreement between the San Jose Arena Management, the PCJPB, and VTA that permits shared use of parking at the San Jose Diridon Caltrain Station during arena events. This agreement includes the 180 parking spaces on VTA property south of West Santa Clara Street and between Cahill and Montgomery Streets for the period before, during, and after arena events. The PCJPB's commitment is for 400 parking spaces during arena events. Vehicles occupying these parking spaces prior to an event can remain according to the Agreement.

3.2.5.4 Transit

There are several passenger rail providers along the project extent, including Caltrain, Capitol Corridor, Altamont Corridor Express (ACE), and Amtrak. The PCJPB owns the corridor between San Francisco and San Jose and operates the Caltrain commuter rail service south to Tamien. Most of the rail services are concentrated along the northern edge of the project extent between the existing Santa Clara Station and San Jose Diridon Station, which currently carries 116 passenger trains per day, including Caltrain, Capitol Corridor, ACE, and Amtrak trains (Capital Corridor Joint Powers Board [CCJPA] 2015; Amtrak 2017; ACE 2018; Caltrain 2017). Forty out of the 116 passenger trains per day provide service between San Jose Diridon Station and Tamien Station, while south of Tamien Station the corridor serves six Caltrain passenger trains per day. UPRR owns the railroad south of Control Point (CP) Lick.

Table 3.2-10 shows existing ridership at San Jose Diridon Station and the current Gilroy station for passenger rail operators. Intercity passenger rail service in California is provided by Amtrak on four principal corridors covering more than 1,300 linear miles spanning most of the state. The existing passenger rail network in the project extent includes the Amtrak Coast Starlight, which follows UPRR tracks from San Jose through Gilroy to Salinas (as part of its West Coast operations from Seattle to Los Angeles, via Sacramento and the Bay Area). The Coast Starlight stops at San Jose, but not at the Gilroy station. The Coastal Starlight departs once daily in either direction.

Table 3.2-10 Existing Rail Ridership at San Jose Diridon and Gilroy Stations

Station	Operator	Weekday Trains	Weekday Boardings (2016)
San Jose Diridon	Caltrain	92	4,710
	Capitol Corridor	14	260
	ACE	8	380
	Amtrak (Coast Starlight)	2	NA
	VTA Light Rail	108	710
Gilroy	Caltrain	6	180

Sources: Caltrain 2016; CCJPA 2015; VTA 2016
NA = not available
ACE = Altamont Corridor Express
VTA = Santa Clara Valley Transportation Authority

Capitol Corridor provides intercity passenger rail service between San Jose, Oakland, and Sacramento. CCJPA, a partnership of six local transit agencies in the eight-county service area, manages the Capitol Corridor service, which Amtrak operates. The service operates seven round trips from Sacramento to San Jose, and an additional seven daily round trips from Sacramento to Oakland. Trains depart about every 1 to 2 hours during the weekdays. Capitol Corridor serves approximately 260 daily riders at San Jose Diridon Station (CCJPA 2015).

Caltrain provides passenger rail service on the San Francisco Peninsula between San Francisco and downtown San Jose with stops in San Mateo County and Santa Clara County. Caltrain is operated under the jurisdiction of the PCJPB and managed by SamTrans. The Caltrain system spans 77 miles of track and has 40 at-grade crossings between San Francisco and San Jose and 30 at-grade crossings between San Jose and Gilroy. As of 2016, Caltrain operates 92 weekday trains including Baby Bullets (express), limited, and local services. Limited service is provided south of San Jose Diridon Station, including Tamien Station (40 trains per day) and Capitol, Blossom Hill, Morgan Hill, San Martin, and Gilroy Stations (six trains per day). The average weekday Caltrain ridership in 2016 was approximately 58,000; of this, approximately 12 percent (6,900 riders) occurred in the project extent, including approximately 4,710 riders at San Jose Diridon Station and 180 riders at the Gilroy station (Caltrain 2016).

ACE provides passenger rail service across the Altamont corridor between San Joaquin, Alameda, and Santa Clara Counties. The service operates four round trips between Stockton and San Jose daily, with trains connecting Stockton to San Jose in the morning and providing reverse service from San Jose to Stockton in the evening. ACE serves approximately 380 daily boardings at San Jose Diridon Station (VTA 2016).

VTA provides light rail, bus, and paratransit service to Santa Clara County. VTA buses include local, community, limited stop, express, and rapid bus services. VTA light rail has two main lines and a spur line totaling approximately 42 miles and 62 stations. The average weekday ridership for VTA in fiscal year (FY) 2016 was approximately 130,500 for both bus and light rail services. VTA light rail serves approximately 710 daily boardings at San Jose Diridon Station (VTA 2016).

BART provides passenger rail transit service to downtown San Francisco to and from cities in the northern portion of the San Francisco Peninsula, including Oakland, Berkeley, Fremont, Walnut Creek, Dublin/Pleasanton, and other cities in the East Bay. The BART system comprises five lines and 45 stations. The average weekday ridership for FY 2016 was approximately 433,400 (BART 2017). BART and VTA are in the process of implementing an extension to Santa Clara that will include new BART stations at San Jose Diridon Station and in Santa Clara.

Amtrak, VTA, and Santa Cruz Metro operate the Highway 17 Express that provides service between Santa Cruz and downtown San Jose with stops at San Jose Diridon Station. It travels

along SR 17 between San Jose and Santa Cruz with weekday services extending to San Jose State University.

Monterey-Salinas Transit operates transit services in Monterey County and southern Santa Cruz County. It has 50 routes serving the Monterey Peninsula and the Salinas Valley. Monterey-Salinas Transit operates intercity services connecting Monterey County to the Gilroy and San Jose Diridon Stations.

San Benito County Express provides bus transit service to the communities of Hollister and San Juan Bautista. It operates fixed-route services as well as paratransit and dial-a-ride services. San Benito County Express provides an intercity service to the existing Gilroy Station and nearby Gilroy destinations.

Amtrak, Greyhound, Megabus, BoltBus, and California Shuttle Bus provide intercity bus service. Amtrak Thruway buses provide four daily round trips from San Jose Diridon Station to Stockton and three daily round trips to Santa Barbara. Greyhound provides service from San Jose Diridon Station and Gilroy to Oakland, San Francisco, Fresno, and Southern California. Megabus, BoltBus, and California Shuttle provide service from San Jose Diridon Station to Southern California.

San Jose Diridon Station Approach Subsection

San Jose Diridon Station has 11 tracks and seven platforms; nine tracks and five at-grade platforms serve Amtrak, Capitol Corridor, Caltrain, and ACE, while VTA light rail uses two tracks and platforms. The station has nine bus bays on a surface drop-off area on Cahill Street between Stover Street and West Santa Clara Street, two bus shelters on Cahill Street, and curbside bus stops on the roadway network around the station area.

San Jose Diridon Station acts as a key transit hub connecting San Jose and Santa Clara County to the Bay Area and the Central Valley. Riders can transfer between five transit operators and 18 transit routes. Approximately 64 buses and 12 trains arrive and depart from San Jose Diridon Station in the peak hour. San Jose Diridon Station also has intercity bus services by Amtrak, Greyhound, Megabus, BoltBus, and California Shuttle. Figure 3.2-5 illustrates existing transit routes at San Jose Diridon Station.

Monterey Corridor Subsection

VTA operates multiple bus routes along Monterey Road in the Monterey Corridor Subsection, totaling 17 buses each direction during the peak hour. Caltrain's Capitol and Blossom Hill Stations are located along the corridor, serving about 190 boardings per day. Caltrain operates only on weekdays during the AM and PM peak periods, with three northbound trains in the AM peak period and three southbound trains in the PM peak period.

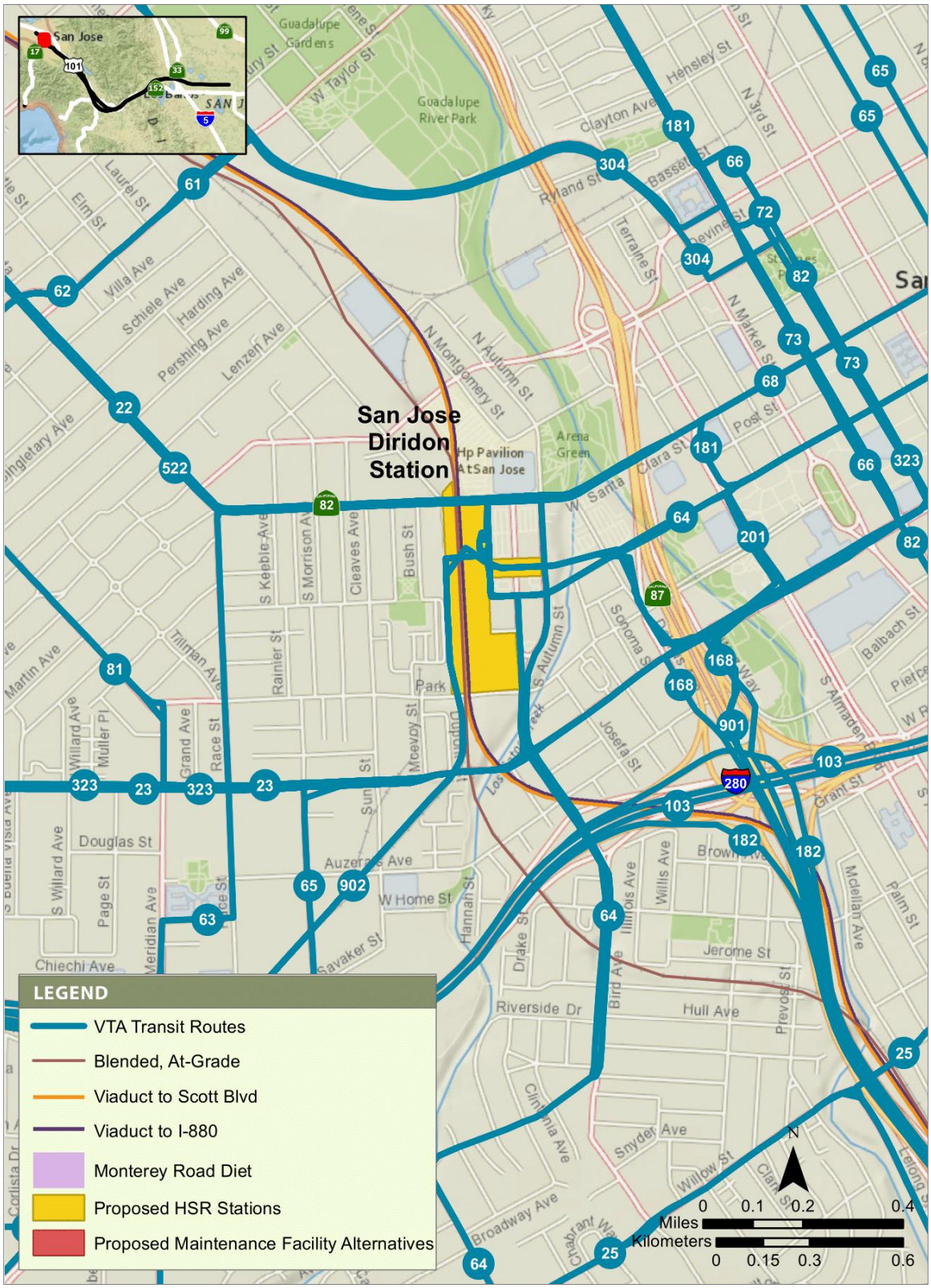
Bus shelters and bus stops exist on both sides of the Monterey Road Corridor north of Blossom Hill Road. South of Blossom Hill Road, bus facilities are only present on the northbound side of Monterey Road. Bus stops are spaced approximately every half mile on Monterey Road.

Morgan Hill and Gilroy Subsection

Caltrain serves the stations in Morgan Hill, San Martin, and Gilroy in the Morgan Hill and Gilroy Subsection. Caltrain operates only on weekdays during the AM and PM peak hours, with three northbound trains in the AM peak period and three southbound trains in the PM peak period. Caltrain serves about 400 daily passengers along this subsection, including about 150 daily boardings at the Gilroy station. Figure 3.2-6 illustrates existing transit routes around the Gilroy station sites.

Pacheco Pass Subsection

Because it is a rural and remote area, there are no bus or passenger rail stations or stops in the Pacheco Pass Subsection RSA. Intercity bus services operated by Greyhound, Megabus, BoltBus, and California Shuttle operate along SR 152 but do not stop along the subsection.



Source: VTA 2017b

MARCH 2019

Figure 3.2-5 San Jose Diridon Station Existing Transit Routes

Source: VTA 2017b

MARCH 2019

Figure 3.2-6 Gilroy Station Existing Transit Routes

San Joaquin Valley Subsection

Because it is a rural and remote area, there is no bus or passenger rail service in the San Joaquin Valley Subsection RSA. The nearest transit services operated by the Transit Joint Powers Authority for Merced County and Greyhound are located outside the RSA in Los Banos.

3.2.5.5 Nonmotorized Travel

The affected environment for nonmotorized travel is described for areas that could experience changes from the project, including the San Jose Diridon and Downtown Gilroy Stations, the roadways around the East Gilroy Station and two potential MOWF sites, and Monterey Road, where lane reductions (road diet are proposed consistent with *Envision: San José 2040 General Plan* (City of San Jose 2018).

Bicycle facilities consist of separated bikeways, bicycle lanes, routes, trails, and paths, as well as bike parking, bike lockers, and showers for cyclists. Pedestrian facilities include sidewalks, crosswalks, trails, and pedestrian signals.

Bicycle facility categories include:

Class I—Provides a completely separated right-of-way for the exclusive use of cyclists and pedestrians with cross-flow minimized (e.g., off-street bicycle paths).

Class II—Provides a striped lane for one-way travel on a street or highway.

Class III—Provides for shared use with motor vehicle traffic; however, are often signed or include a striped bicycle lane.

Class IV—Provides a right-of-way designated exclusively for bicycle travel adjacent to a roadway and protected from vehicular traffic. Types of separation include, but are not limited to, grade separation, flexible posts, or inflexible physical barriers (City of San Jose 2018).

San Jose Diridon Station Approach Subsection

Several streets in the San Jose Diridon Station project footprint include bicycle facilities (e.g., bicycle paths, lanes, parking, signage and signals, and cycle tracks). Santa Clara Street has Class II bicycle lanes in both directions, as does Park Avenue south of Montgomery Street. South of Crandall Street, Cahill Street provides green-painted Class II bicycle lanes in both directions; these lanes connect to buffered green-painted Class II bicycle lanes on West San Fernando Street. Figure 3.2-7 illustrates the existing bicycle facilities in the San Jose Diridon Station area.

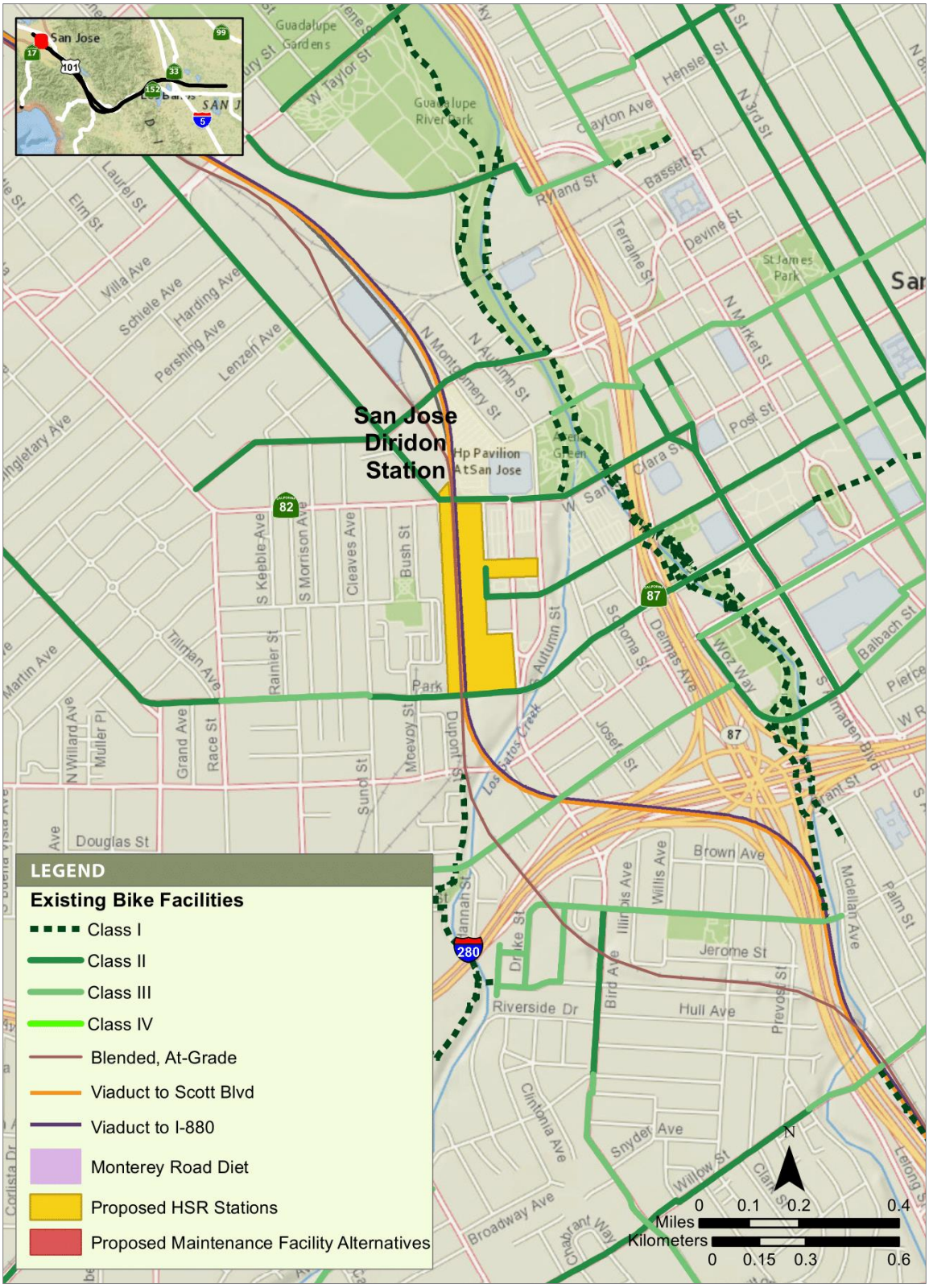
The station provides 16 bicycle parking spaces at outdoor bicycle racks, and 48 bicycle parking spaces in reserved lockers, for a total of 64 bicycle parking spaces. A 27-space Bay Area Bike Share station is located on the south side of Crandall Street.

Pedestrian facilities (e.g., sidewalks, curb ramps, marked crosswalks, sidewalk furniture such as benches or trash cans, and pedestrian signals) in the San Jose Diridon Station Approach Subsection include sidewalks throughout the station footprint, on both sides of Cahill Street, West San Fernando Street, Crandall Street, Stover Street, South Montgomery Street, West Santa Clara Street, and Park Avenue. Sidewalks are provided on all sides of the bus facility, and along the driveway between two parking facilities between Cahill Street and South Montgomery Street.

Most intersections in the station area provide marked pedestrian crossings on all approaches of the intersection. At the intersection of Santa Clara Street and Cahill Street, the north side of the intersection has a marked pedestrian crosswalk, and the east and south sides of the intersection have marked continental-style crosswalks. There is no crosswalk on the west side of the intersection. At the intersection of The Alameda, Stockton Avenue, and White Street, there are marked crosswalks on the north, west, and south sides of the intersection. There is no crosswalk on the east side of the intersection. Pedestrians and cyclists in the station area primarily travel in an east-west direction between San Jose Diridon Station and downtown San Jose. Pedestrian volumes increase substantially for short time periods before and after events at the SAP Center on Santa Clara Street.

Continental Crosswalks

There are two types of crosswalk designs: traditional parallel lines and high-visibility patterns. High-visibility patterns include the ladder, continental, and diagonal designs. The continental design uses thick, solid lines that cross the street perpendicular to the direction of pedestrian traffic.



Source: Authority 2019a

APRIL 2019

Figure 3.2-7 San Jose Diridon Station Existing Bicycle Facilities

Monterey Corridor Subsection

Monterey Road provides Class II bicycle lanes in both directions from north of the Capitol Expressway interchange to Bernal Way. The bicycle lanes from Capitol Expressway to approximately 400 feet north of the interchange with Blossom Hill Road have a striped space between the bike lane and the vehicle travel lane that provides a buffer between cars and bikes. Monterey Road provides continuous sidewalks on the east side of the roadway from the Capitol Expressway interchange to Tennant Avenue and from Hicks Lane to Bernal Way. There are no sidewalks between Tennant Avenue and Hicks Lane where the road passes under SR 85. Monterey Road provides a sidewalk on the east side of the roadway from Hicks Lane to Forsum Road. No sidewalks are provided on either side from Forsum Road to Metcalf Avenue. For this portion of the roadway, the Coyote Creek multiuse trail operates parallel to the roadway to the east.

Marked pedestrian crossings are present at most signalized intersections along Monterey Road. Side street stop-controlled intersections do not have marked crosswalks at most locations. At the Monterey Road and Blossom Hill Road on-ramps, a pedestrian bridge, Xander's Crossing, provides pedestrian access across Monterey Road just south of Blossom Hill Road.

Morgan Hill and Gilroy Subsection

There are no on-street bicycle facilities within the Downtown Gilroy Station project footprint. The existing Caltrain station provides 13 bicycle racks and 30 bicycle lockers, for a total of 43 bicycle parking spaces. Nearby Class II bike lane facilities are provided on Chestnut Street between 6th Street and 10th Street, 6th Street between Maple Street and Camino Arroyo, West 10th Street west of Monterey Road, and Monterey Road south of 10th Street. Figure 3.2-8 illustrates the existing bicycle facilities in the Downtown Gilroy Station area.

Sidewalks are provided on Monterey Road in both directions in the Downtown Gilroy Station area. East 7th Street includes sidewalks on both sides of the right-of-way, as well as an at-grade pedestrian crossing of the existing rail tracks. Alexander Street includes sidewalks on the east side of the street only from the Old Gilroy Street/East 7th Street intersection to approximately 170 feet north of East 10th Street. Beginning 170 feet north of East 10th Street, there are sidewalks on both sides of Alexander Street. While East 10th Street provides sidewalks on both sides of the roadway, south of East 10th Street there are sidewalks only on the east side of Alexander Street through the remainder of its length in the station area.

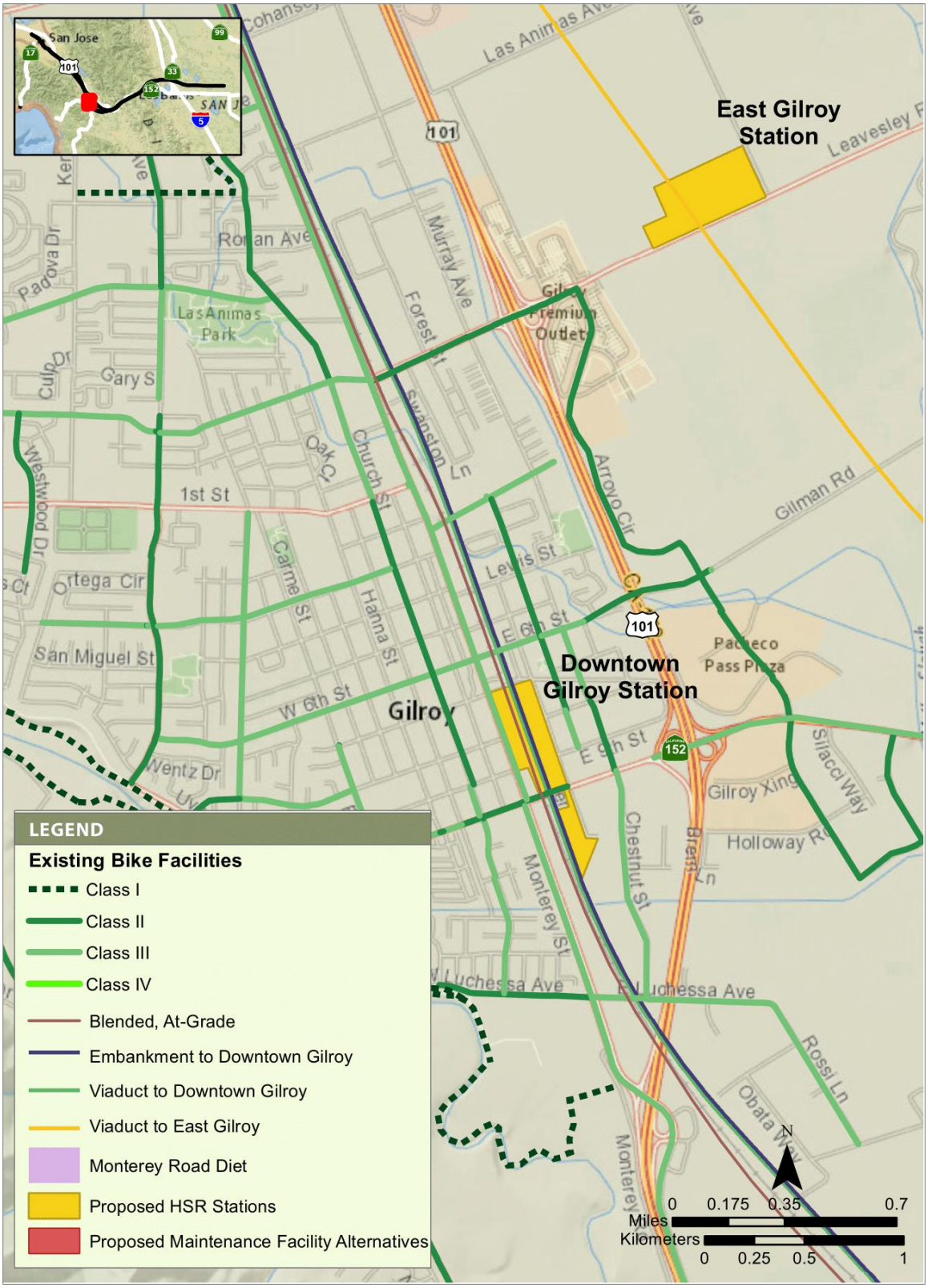
Marked pedestrian crossings are provided at all signalized intersections in the station area. Stop-controlled intersections, such as Alexander Street/Old Gilroy Street and Monterey Road/Ninth Street, have no marked crossings. At the East Gilroy Station site, Leavesley Road currently provides sidewalks and Class II bike lanes between Monterey Road and Arroyo Circle. Marked pedestrian crossings are provided on at least three approaches of all signalized intersections. East of Arroyo Circle, there are no bike or pedestrian facilities on Leavesley Road. There are no bicycle or pedestrian facilities provided on SR 152, SR 25, Bloomfield Road, or Frazier Lake Road in the RSA near the MOWF sites.

Pacheco Pass Subsection

Because it is a rural area, no nonmotorized transportation facilities are provided in the Pacheco Pass Subsection RSA. Walking and biking are accommodated along the shoulder of SR 152 and other rural roadways in the RSA.

San Joaquin Valley Subsection

Because it is a rural area, no nonmotorized transportation facilities are provided in the San Joaquin Valley Subsection RSA. Walking and biking are accommodated along the shoulder of Henry Miller Road and other rural roadways in the RSA.



Source: Authority 2019a

APRIL 2019

Figure 3.2-8 Gilroy Station Existing Bicycle Facilities

3.2.5.6 Freight Rail Service

Railroad subdivisions and control points in the transportation RSA are illustrated on Figure 3.2-9 and Figure 3.2-10. North of CP[9] Coast at Caltrain milepost (MP) 43.9 in Santa Clara, freight trains and Caltrain passenger trains both use the same tracks in the PCJPB-owned Caltrain Corridor, although there are areas where freight has exclusive spur tracks and sidings that lead to customer locations outside the PCJPB right-of-way. From CP Coast to CP Lick (MP 52.0, south of downtown San Jose in the Communication Hill area), freight service operates on a UPRR-owned dedicated freight track (MT-1) in the PCJPB-owned Caltrain corridor along with other tenant passenger service (ACE, Amtrak, and Capitol Corridor). South of CP Lick, freight service operates on UPRR-owned track and right-of-way to Gilroy and points farther south. From CP Lick to Gilroy, freight shares track with Caltrain service. South of Gilroy, freight service operates on the Coast Subdivision to Salinas and points south and on a spur line (the Hollister Branch) from Carnadero to Hollister. In the Central Valley, a short-line operator operates freight on the Westside Line from Tracy to Los Banos.

Caltrain dispatches all tracks in the Caltrain Corridor north of CP Lick. South of CP Lick, UPRR dispatches trains on its system, including Caltrain passenger trains. Analysts reviewed PCJPB dispatch data for freight operations in the Santa Clara to Gilroy area in December 2012,[10] which indicated an average of five round trips per day and a daily one-way trip that traverse portions of the RSA as follows:

- Mission Bay—From South San Francisco freight yard to Newhall Yard in San Jose, one daily round trip.
- Salinas—From south of Gilroy to CP Coast and points east, one daily round trip.
- Granite Rock 1—From south of Gilroy to Newhall Yard in San Jose, one daily round trip.
- Granite Rock 2—From Warm Springs Subdivision and points east (via CP Stockton, MP 45.6) to Newhall Yard in San Jose, one daily round trip.
- Permanente—From Vasona Industrial Lead (via CP Bird at MP 46.9) and points west to Warm Springs Subdivision (via CP Shark, MP 46.3), one daily round trip.
- MRVSJ—From Roseville to San Jose via CP Coast, one daily one-way trip.

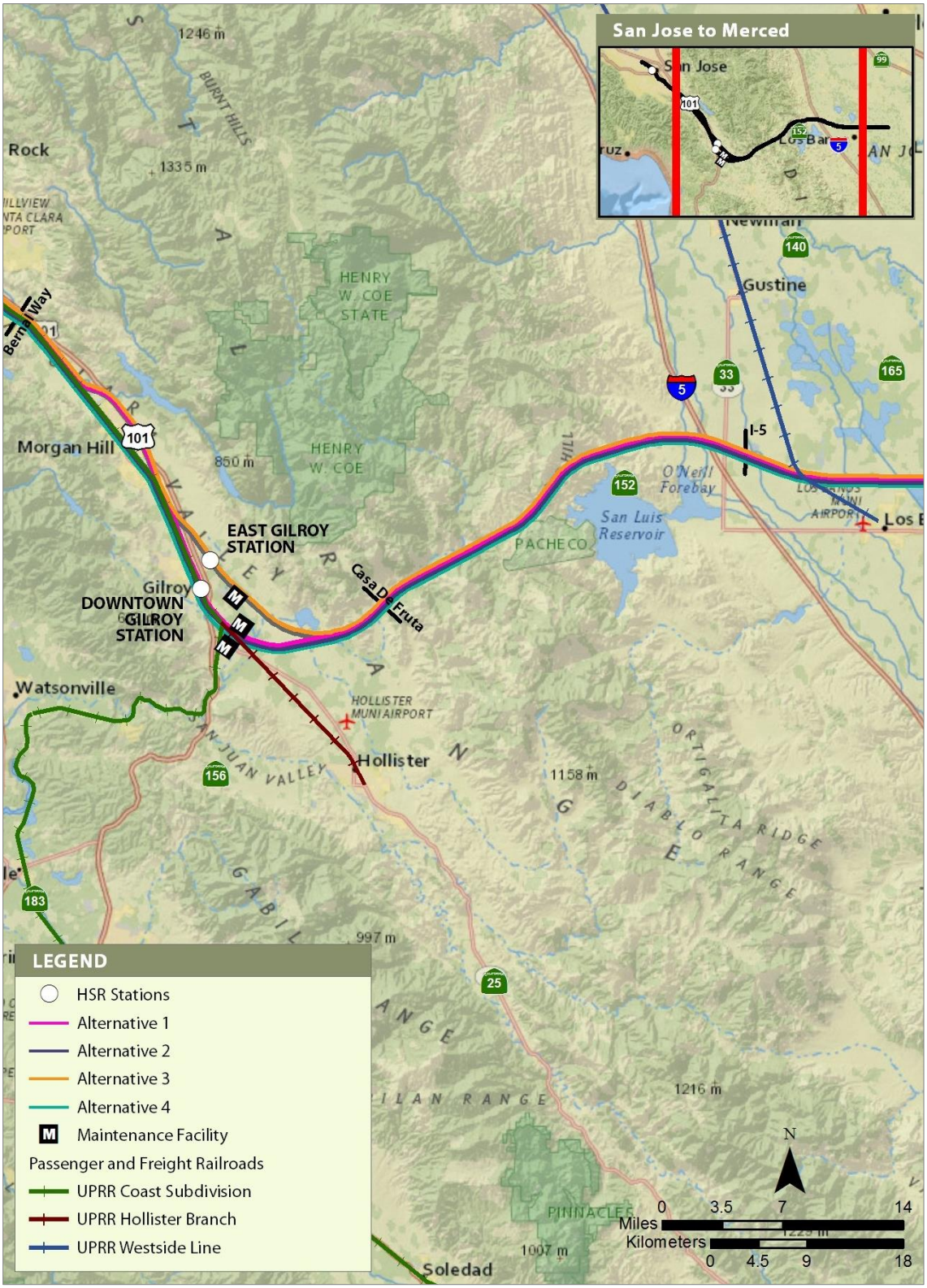
Freight service varies in response to freight customer needs and activity. For example, there was a notable decline in freight operations during the 2008–2009 recession and slow recovery afterwards, but freight service has been increasing in recent years with the acceleration of the economic recovery. In addition to the routine daily traffic, freight operators also run periodic trains to serve nonroutine episodic freight needs. The Peninsula Freight Rail User's Group estimates that the number of rail cars between San Jose and San Francisco over the past decade has averaged about 60 to 80 cars per day in each direction (once loaded, once empty). This translates to 20,000 to 30,000 loaded rail cars carrying 2 to 3 million tons of cargo between San Jose and the San Francisco Peninsula each year, the equivalent of at least 100,000 truck trips annually. During peak years in the past decade, the numbers were substantially higher (Peninsula Freight Rail User's Group 2014).

[9] A control point is a location with signals where the dispatcher controls track access. Control points are commonly associated with track junctions.

[10] This was the only data made available to HSR by Caltrain.

Source: Authority 2019a MARCH 2019

Figure 3.2-9 Railroad Control Points and Subdivisions in the RSA (San Jose Diridon Station Approach Subsection)



Source: Authority 2019a

MARCH 2019

Figure 3.2-10 Railroad Control Points and Subdivisions in the RSA (Morgan Hill and Gilroy and Pacheco Pass Subsections)

For the Final EIR/EIS, in order to ensure that existing conditions were characterized accurately, the Authority requested additional data from Caltrain, and Caltrain provided detailed freight dispatch data, including times of train movements for October 2019 and daily counts of freight, train consist[11] movements, lengths, and tonnage for September through November 2019 (PCJPB 2019).

The area of concern for potential constraints on freight operations with the HSR project is on the area from CP Coast north of the Santa Clara Station northward to San Francisco. This is the section of the Caltrain Corridor where passenger rail operations and freight rail operators operate on the same tracks and where the combination of the increase in HSR train operations and Caltrain train operations could affect the timing of windows available for freight rail operations. As described above, south of CP Coast, freight operates on the dedicated track MT-1, which UPRR owns, although Caltrain controls dispatching of trains southward to CP Lick, which is approximately 2 miles south of the Tamien Station.

A review of the October 2019 Caltrain dispatch data indicates that freight service is roughly consistent with the description above based on the 2012 dispatch data concerning the existing freight operations between CP Coast and San Francisco. The comparison of the 2019 and 2012 data is summarized below:

- The South City Switcher (also called the South City Local) operates in the morning, serves industries located between South San Francisco and Pier 96 in San Francisco, and makes approximately one round trip per day from the South San Francisco Yard to San Francisco. Based on 2019 data, this service on average starts around 10:00 a.m. and ends around 11:30 a.m., with an average duration in the Caltrain Corridor of 1.2 hours. The 2019 data is roughly consistent with the 2012 data.
- The Broadway Local starts operating in the evening and serves industries between South San Francisco and Redwood City, such as the Port of Redwood City. Based on 2019 data, the service on average starts around 7:15 p.m. and ends around 11:15 p.m., with an average duration in the Caltrain Corridor of 3.8 hours. The 2019 data is roughly consistent with the 2012 data, except that the 2012 data indicated this service was on average completing the service in slightly less time (3.2 hours) and ending around 10:15 p.m.
- The Mission Bay Hauler operates in the evening between San Jose/Milpitas and the South San Francisco yard and sometimes San Jose/Milpitas to Redwood City. This service gathers up the outbound train cars brought in by the other two local train services and hauls them to the UPRR yard in Milpitas, then returns with the inbound cars for distribution by local services. Based on 2019 data, the service on average starts around 7:30 p.m. and ends around 11:15 p.m., with an average duration in the Caltrain Corridor of 3.6 hours. The 2019 data is roughly consistent with the 2012 data, except that the 2012 data indicated this service was taking longer in 2012 than in 2019 and ending service after midnight.[12]
- The Granite Rock service operates in the evening from south of CP Link to Redwood City (CP Junction) and hauls construction material between Granite Rock facilities and the Port of Redwood City. In the 2012 dispatch data, this service was only shown as operating from south of CP Lick to the Newhall Freight Yard, but in 2019 this service was continuing to Redwood City.

[11] A train "consist" is a locomotive plus train cars. For example, a passenger train "consist" includes a locomotive and passenger cars and a freight train "consist" includes a locomotive (or multiple locomotives) plus the freight cars.

[12] According to the 2019 data, the average round trip time of this service north of CP Coast was approximately 5.0 hours, ending at 12:23 a.m. In the 2019 data, the round trip time of this service north of CP Coast was approximately 3.6 hours, ending at 11:16 p.m. All times and durations are calculated from CP Coast northward only (because this is the constrained section where HSR trains, Caltrain trains, and freight would share tracks and there is a dedicated freight track south of CP Coast).

- Overall, the portrayal of freight service based on the 2012 data is not substantially different when considering the more recent 2019 data provided by Caltrain. Based on 2019 dispatch data, there is an average of three round trips per weekday in the Caltrain Corridor between CP Coast and San Francisco, which is the same amount of average freight service described in the 2012 dispatch data. For any specific section of the corridor north of CP Coast, based on the 2019 dispatch data, there are only two round trips per weekday because not all round trips utilize all of the corridor. The freight pattern of one short round trip in the morning between South San Francisco and San Francisco and several round trips in the evening/at night between San Jose and South San Francisco described in the Draft EIR/EIS is the same pattern shown in the 2019 data.

South of CP Coast, based on the 2019 dispatch data, there are various services that operate using the freight-dedicated tracks, including the Mission Bay Hauler and Granite Rock services described above, as well as other freight service that serves the East Bay via the UPRR Coast Subdivision and Milpitas via the UPRR Warm Springs Subdivision or the Vasona Industrial Lead.

South of Gilroy, UPRR operates on the Coast Subdivision to Salinas and on the Hollister Branch. The Coast Subdivision south of Gilroy has one and sometimes two tracks, and has approximately four to six daily freight trains. The Coast Subdivision south of Gilroy is parallel to the RSA for a short distance. The Hollister Branch is a light-density branch line that diverges from the Coast Subdivision at Carnadero about 2.3 miles south of the Caltrain Gilroy Station. The Hollister Branch, which has one track parallel to the RSA for a short distance, operates limited to no daily freight service. There are no freight lines and no freight service from Gilroy to Los Banos.

East of the Pacheco Pass, California Northern leases UPRR's Westside Line for freight service from Tracy to Los Banos. The Westside Line has one track with infrequent daily freight service. The RSA crosses the Westside Line near Volta north of Los Banos.

Where freight and HSR would share corridors, adequate clearance would need to be provided by the overhead passenger service wires to accommodate freight rail service. Analysts reviewed dispatch data to identify the highest freight car (or *load*) that PCJPB authorized on different portions of Caltrain corridor in the RSA. Between Scott Boulevard and CP Lick, the highest freight car height was 20.25 feet (Caltrain dispatch data 2006–2013, as cited in the PCEP EIR [PCJPB 2015]).[13]

Trackage Rights Agreement between the Peninsula Corridor Joint Powers Board and Union Pacific Railroad

When the PCJPB acquired the Caltrain corridor, PCJPB and UPRR's predecessor, the Southern Pacific Transportation Company, entered into a trackage rights agreement (TRA) that established the rights of each of the parties relative to the corridor. The parties negotiated the TRA in 1991, with the understanding and expectation that passenger service would increase over time. This increase could ultimately affect the available times for freight operations in the corridor.

In December 2016, UPRR and PCJPB agreed to a series of agreements related to the implementation of PCJPB's project to electrify the line that included a proposed transfer of the freight rights and intercity passenger rights from UPRR to the PCJPB for the portion of the Caltrain corridor from CP Coast north to San Francisco. The agreement established a three-phase process by which PCJPB and UPRR would initiate a selection process to identify a third-party short-line railroad operator, select an operator and obtain Surface Transportation Board approvals, and then PCJPB would obtain the freight and intercity passenger rights for this portion of the Caltrain corridor, among other requirements. As of September 2019, the existing TRA is still in force for the Caltrain corridor until the transfer is implemented north of CP Coast and a new TRA is established for the area between CP Coast and CP Lick.

[13] Freight heights have not changed since 2013 as there are overhead height limits that constrain use of taller equipment.

The following are key requirements regarding freight or passenger rights pursuant to the existing TRA and December 2016 agreement:

- PCJPB owns the right-of-way, known as the Peninsula Main Line, and associated tracks between San Francisco and CP Lick, and controls the commuter passenger rail rights.
- UPRR owns certain tracks along the corridor including the track referred to as MT-1 from Santa Clara (CP Coast) southward.
- UPRR owns the freight rights and intercity passenger rail rights of the Caltrain corridor and has agreed conditionally to transfer the freight rights and intercity passenger rail rights north of CP Coast per the December 2016 agreement.
- The TRA does not limit freight service hours on the UPRR-owned MT-1 track between CP Coast and CP Lick.
- The existing TRA, as amended by subsequent agreements with UPRR regarding the PCEP, establishes required vertical clearance heights at specific constrained locations along the corridor.[14]
- The existing TRA requires PCJPB to allow for one daytime 30-minute freight window between 10 a.m. and 3 p.m., but the freight trains must be capable of operating at *commuter service train speeds* and must do so if directed by PCJPB. Once PCJPB obtains the freight rights, it can amend this requirement north of CP Coast pursuant to the terms of a TRA to be entered into with the new freight operator selected pursuant to a competitive procurement process.
- The existing TRA requires PCJPB to provide one track for exclusive freight use between midnight and 5 a.m. Once PCJPB obtains the freight rights, it may be possible to modify this requirement north of CP Coast pursuant to the terms of a TRA to be entered into with the new freight operator selected pursuant to a competitive procurement process.
- Section 8.3(c) of the existing TRA recognizes that if PCJPB has a need to construct a transportation system that is a significant change in the method of delivery of commuter service and that system is inconsistent with freight service, PCJPB can file for permission from the Surface Transportation Board to abandon freight service over the affected area and UPRR may not object to or oppose such a filing.

3.2.6 Environmental Consequences

3.2.6.1 Overview

This section discusses the potential transportation impacts that would result from implementing the project alternatives. It is organized according to topic: roadways, freeways, and intersections (vehicle circulation); parking; transit; nonmotorized travel; and freight rail service. Each topic area discusses potential impacts from construction (temporary conditions) and operations (permanent conditions) of the project. Impacts on transportation from implementing the project would include intersection or freeway LOS impacts, construction-period impacts on adjacent properties, impacts on feeder transit services, impacts on nonmotorized modes of travel such as bicycle and pedestrian facilities, and impacts on freight service.

The project includes project features (IAMFs) that will minimize impacts on transportation during construction by requiring the contractor to develop and implement plans and actions to minimize or avoid potential construction impacts (Volume 2, Appendix 2-E). These IAMFs include implementing construction hours and parking for construction vehicles, maintaining truck routes and construction for special events during project construction, maintaining bicycle and pedestrian access, protecting freight and passenger rail services, maintaining transit access, and meeting design standards and guidance for transportation facilities. However, temporary road

[14] Within the Caltrain Corridor from CP Lick to Scott Boulevard, the effective overhead clearance height in the TRA allows for Plate H equipment (20.25 feet).

closures and construction traffic, including traffic from truck deliveries and construction employee trips, would result in localized temporary impacts in a number of areas in the RSA. Permanent transportation consequences would result from the long-term presence of HSR track and systems. There would be an increase in localized trips near the stations, as well as localized consequences for intersection and freeway operations, transit service, and bicycle and pedestrian facilities.

While the project may result in temporary impacts during construction and operations at isolated areas around stations and in the project footprint, its overall impact on transportation resources in the region and state would be beneficial through substantial reductions in VMT, increased transit connectivity, and reduction in the need to expand freeways and airports.

3.2.6.2 Roadways, Freeways, and Intersections (Vehicle Circulation)

Construction and operations of the project alternatives would result in temporary and permanent changes to roadways, freeways, and intersections to accommodate the new HSR infrastructure. Project construction would affect major roadways and intersections through temporary and permanent road closures and relocations that would result in temporary or permanent diversion of traffic onto other roadways and freeways. Permanent changes to roadways and intersections would also cause increased congestion where vehicle capacity is reduced or changed, for example, along Monterey Road in San Jose. Project-related construction traffic would affect vehicle circulation in areas where construction activities are occurring, either through the temporary closure of traffic lanes or through heavy truck traffic delivering or removing materials from the project site. Construction activities would have a greater effect under Alternatives 1, 2, and 3 due to construction related to the narrowing of Monterey Road. The construction effort for the design variants would be approximately the same as for the alternatives without the DDV and the TDV and thus construction traffic would be approximately the same. The construction of the design variants would not affect any different transportation facilities than the alternatives without the DDV and TDV. Project operations would affect major roadways, freeways, and intersections through traffic generated by passengers traveling to and from the station areas and maintenance facility. Project trips would affect intersection and freeway LOS by increasing the amount of traffic traveling to and from the station or reducing roadway capacity, causing intersections and freeway segments that currently operate at acceptable conditions to fail, or contribute to already failing intersections and freeway segments to have higher delays.

No Project Conditions

The Authority studied two future years under the No Project conditions—2029 and 2040. The population in the Bay Area and San Joaquin Valley is expected to see continued growth through 2040 (Section 2.5.1.1, Planned Land Use). The population in the San Joaquin Valley is projected to grow at a higher rate than in any other region in California. Development in the Bay Area and San Joaquin Valley to accommodate the population increase would continue under the No Project Alternative and result in associated direct and indirect impacts on transportation. Such planned and other reasonably foreseeable projects anticipated to be built by 2029 and 2040 include residential, commercial, industrial, recreational, and transportation projects. A full list of anticipated future development projects is provided in Volume 2, Appendix 3.18-A, Cumulative Plans and Nontransportation Projects List, and Appendix 3.18-B, Cumulative Transportation Projects List.

Although future transportation improvement projects as identified in RTPs (Volume 2, Appendix 3.19-B) would provide transportation benefits such as expanded capacity, thus improving safety, and reducing traffic volumes in the short term, the programmed transportation network capacity improvements would not be enough to meet long-term future demand and population growth. Under the No Project Alternative, traffic volumes on regional roadways would continue to increase as a result of anticipated development through 2040, thereby affecting existing roadways, freeways, and intersections and resulting in increased delays and a degradation of LOS.

To accommodate continued growth in the Bay Area and San Joaquin Valley, programmed transportation improvements would expand existing capacity. Without the additional capacity provided by the project, additional improvements to highways, airports, and other transportation facilities beyond those currently programmed would be required to meet the growing demand regionally and statewide. The Authority estimates that additional highway and airport projects (up to 4,300 highway lane miles, 115 airport gates, and 4 airport runways) would be needed to achieve equivalent capacity and relieve the increased pressure (Authority 2018a). Table 3.2-11 shows the improvements programmed for implementation by 2029 and 2040. These consist primarily of individual interchange improvements and roadway widening projects on segments of the existing transportation network. Most of the projects listed would be completed by 2029 and were considered in both analysis scenarios, with the notable exception of a number of projects in Gilroy. These projects would primarily affect the San Jose Diridon Station area and MOWF alternatives in Gilroy.

Table 3.2-11 2029 and 2040 No Project Conditions Roadway Improvements

Roadway Change	Source	2029	2040
San Jose Diridon Station Approach Subsection			
Hedding Street road diet[1]	*Envision: San José 2040 General Plan*	X	X
Signal modifications	*Diridon Station Area Plan*	X	X
Montgomery Street conversion to two-way traffic	*Diridon Station Area Plan*	X	X
Montgomery Street closure south of West San Fernando	*Diridon Station Area Plan*	X	X
Autumn Street conversion to two-way traffic	*Diridon Station Area Plan*	X	X
New facility: Autumn Street extension	*Envision: San José 2040 General Plan*	X	X
Park Avenue road diet[1]	*Envision: San José 2040 General Plan*	X	X
Bird Avenue road diet[1]	*Envision: San José 2040 General Plan*	X	X
Delmas Avenue and West Santa Clara Street new traffic signal	City of San Jose	X	X
Coleman Avenue widening	*Envision: San José 2040 General Plan*	X	X
Monterey Corridor Subsection			
Blossom Hill Road lane reduction	*Envision: San José 2040 General Plan*	X	X
Blossom Hill Road interchange widening	*Envision: San José 2040 General Plan*	X	X
Morgan Hill and Gilroy Subsection			
New facility: US 101 and Buena Vista ramps	*North Gilroy Neighborhood Districts Urban Service Area Amendment*		X
Monterey Road widening	*North Gilroy Neighborhood Districts Urban Service Area Amendment*	X	X
New facility: Camino Arroyo extension	*2020 General Plan*		X
New facility: Cameron Boulevard extension	*2020 General Plan*		X
New facility: IOOF Avenue extension	*2020 General Plan*		X
10th Street widening	*North Gilroy Neighborhood Districts Urban Service Area Amendment*	X	X

Roadway Change	Source	2029	2040
SR 152 widening	*North Gilroy Neighborhood Districts Urban Service Area Amendment*	X	X

Sources: City of San Jose 2018, 2014b; City of Gilroy 2002, 201.
US = U.S. Highway
SR = State Route
[1] A road diet is a reduction in roadway capacity, usually achieved by removing lanes.

Table 3.2-12 shows the number of freeway segments forecast to operate at LOS E or F in 2029 and 2040 No Project conditions (Tables 4 and 6 in Appendix 3.2-A provide the LOS for all freeway segments). Five of the segments in the 2029 No Project conditions and seven of the segments in the 2040 No Project conditions that operate at LOS E or F are northbound freeway segments in the AM peak hour.

Table 3.2-12 2029 and 2040 No Project Freeway Segment Operations

Subsection	Number of Study Freeway Segments	Segments Operating at LOS E or F	
		2029 No Project	2040 No Project
Monterey Corridor	10	7	7
Morgan Hill and Gilroy	10	0	2

Source: Authority 2019a

In the 2029 No Project condition in the northbound direction, the freeway segments from lane drop (southbound) to SR 85, SR 85 to Bernal Road, Bernal Road to Silver Creek Valley Road, Silver Creek Valley Road to Hellyer Avenue, and Hellyer Avenue to Yerba Buena Road operate at LOS E or F. In the 2029 No Project condition in the southbound direction, Silver Creek Valley Road to Hellyer Avenue and Hellyer Avenue to Yerba Buena Road segments would operate at LOS E or F. In the 2040 No Project condition in the northbound direction, SR 25 to Monterey Road, SR 152 to Leavesley Road lane drop (southbound) to SR 85, SR 85 to Bernal Road, Bernal Road to Silver Creek Valley Road, Silver Creek Valley Road to Hellyer Avenue, and Hellyer Avenue to Yerba Buena Road segments would operate at LOS E or F. In the 2040 No Project condition in the southbound direction, Silver Creek Valley Road to Hellyer Avenue and Hellyer Avenue to Yerba Buena Road segments would operate at LOS E or F.

Table 3.2-13 shows the number of intersections forecast to operate at LOS E or F in the 2029 and 2040 No Project conditions (Tables 3 and 5 in Appendix 3.2-A provide the LOS for all intersections). In the San Jose Diridon Station Approach Subsection, the traffic generated by projected jobs and population in San Jose create high demand volumes and a congested roadway system, particularly in downtown San Jose around Diridon Station. In the Monterey Corridor Subsection, the high level of congestion is from high demand and constrained roadway choice. Thirteen of the 30 intersections operating at LOS E or F are located on Monterey Road. In the Morgan Hill and Gilroy Subsection, intersections experience lower demand volumes than the San Jose Diridon Station Approach and Monterey Corridor Subsections, and therefore significantly fewer intersections operate at LOS E or F. No intersections were studied in the Pacheco Pass Subsection. The San Joaquin Valley Subsection intersection experiences low demand volumes and does not operate at LOS E or F in 2029, but would operate deficiently in 2040.

Table 3.2-13 2029 and 2040 No Project Intersection Operations

Subsection	Number of Study Intersections	Intersections Operating at LOS E or F	
		2029 No Project	2040 No Project
San Jose Diridon Approach	50	16	26
Monterey Corridor	46	20	30
Morgan Hill and Gilroy	101	11	17
Pacheco Pass	0	0	0
San Joaquin Valley	1	0	1

Source: Authority 2019a

Project Impacts

Construction Impacts

Impact TR#1: Temporary Congestion/Delay Consequences on Major Roadways, Freeways, and Intersections from Temporary Road Closures, Relocations, and Modifications

Construction activities in urban areas associated with the station, platform, and track alignment would require temporary roadway closures or modifications, lane closures and underground utility work that would lead to changes in vehicle circulation, temporary disruption of transportation systems operations, and possible damage to the roadway system such as pavement and bridges. Changes related to major roadways, freeways, and intersections would include:

- Temporary full or partial roadway closures, with associated detours
- Temporary lane closures with associated detours
- Temporary damage to pavement conditions because of construction traffic and rerouting
- Temporary changes to traffic signal operations, timing, and/or phasing to accommodate project construction
- Temporary lane width reductions and/or reduced speed limits
- Temporary loss of or modifications to parking, bicycle facilities or pedestrian facilities

Exact locations of temporary closures, changes, and disruptions would be determined and minimized during the development of a construction transportation plan (CTP).

Construction activities related to MOWFs in more rural areas would result in the same temporary effects on roadways. Construction of station, platform, and track and track alignment structures would require temporary construction easements (TCE), which would require the temporary closures of parking areas or roadway travel lanes, and the construction of overcrossings and interchanges. These activities would increase traffic congestion on roadways, freeways, and intersections because of lane or street closures, diversions in traffic from temporary detours, and other temporary disruptions to traffic.

In rural areas, construction activities would include the demolition and clearance of structures in the rights-of-way, construction of grade separations that would require temporary relocation of existing roads or construction of new temporary roads, construction of the MOIS, and placement of railbeds and HSR track and systems. In rural areas, the primary traffic consequences during construction would occur at locations where overcrossings would be needed to carry minor roadways over the tracks.

Construction of Alternatives 1, 2, and 3 would include a new HSR overcrossing of I-280, including the construction of foundations for bridge pier footings, placement of structural elements, and removal of falsework. Construction of Alternative 4 would include a substantial widening of the

existing overcrossing along the same alignment. These activities would result in temporary highway lane closures and width reductions, reduced speed limits, temporary on- and off-ramp closures, detours, and temporary freeway closures. The duration would range from several hours in the case of a short-term freeway lane closure to months in the case of substantial roadway modifications. A limited number of weekend full closures of I-280 would be required to construct the overcrossing of the freeway under all four alternatives. These closures would be done in close coordination with Caltrans.

In the San Jose Diridon Station Approach Subsection, Alternative 1 would have fewer construction effects than Alternatives 2 and 3 because the northern terminus of dedicated HSR track on a viaduct would be at I-880 rather than Scott Boulevard. Viaduct construction in this subsection would extend approximately 2.4 miles farther north under Alternatives 2 and 3, thereby affecting properties and transportation facilities in those areas. Two additional roadway overcrossings would be affected under Alternatives 2 and 3. Viaduct construction generally involves relocating utilities, pouring footings, forming and pouring columns, forming and pouring an aerial bridge, and constructing track. Alternative 4 would have fewer construction effects than Alternatives 1, 2, and 3 because it would not require viaduct construction and much of the work would occur in the existing UPRR right-of-way.

In the Monterey Corridor Subsection, Alternatives 1 and 3 would continue the viaduct construction farther south in the median of Monterey Road. This work would largely be accomplished in the existing right-of-way of Monterey Road (between Capitol Expressway and Blossom Hill Road). While temporary road closures and detours would be necessary to construct the viaduct in this area, there would be less construction effects than Alternative 2. Under Alternative 2, the project would be built on an embankment. Embankment construction in the Monterey Corridor Subsection would have more effects on transportation facilities because it would require the relocation and reconstruction of Monterey Road to the east. This would entail roadway closures, detours, and relocations. New overcrossings and interchanges would be necessary at Capitol Expressway, Skyway Drive, Branham Lane, Chynoweth Avenue, and Blossom Hill Road. In order to reconstruct these overcrossings/ interchanges, either new temporary facilities would need to be built or the roadways would need to be closed. Under either approach, the temporary roadway detours and relocations would likely result in temporary increases in travel times, delay, and inconvenience to the traveling public. Alternatives 1, 2, and 3 would narrow Monterey Road from six to four lanes between Capitol Expressway and Blossom Hill Road during construction, with the elimination of left turn movements from Monterey Road onto all connecting streets. These narrowing and turn restrictions would occur for approximately 18 to 24 months. Construction of Alternative 4 would not require narrowing of Monterey Road. Alternative 4 would be built at grade and would build new quad gates at Skyway Drive, Branham Lane, and Chynoweth Avenue. There would be temporary closures and detours during off-peak travel times for deliveries and construction access. Alternative 4 would have fewer construction effects than Alternatives 1, 2, and 3 because Monterey Road would retain its existing cross section.

Under Alternatives 1, 2, and 3, narrowing Monterey Road during construction would shift traffic patterns along Monterey Road and in the surrounding area, causing increased delays and congestion at many intersections. During construction of Alternatives 1, 2, and 3, 27 out of 46 intersections studied in the Monterey Corridor Subsection would operate at LOS E or F; 23 of these would be affected by the project. Under Alternative 2, Skyway Drive Variants A and B would have the same construction effects. Eleven of the 23 affected intersections are on Monterey Road, while the remaining 12 would occur because of traffic diversion on to neighborhood streets. For Alternative 4, 10 intersections would continue to operate at LOS E or F, and no intersections would be adversely affected by the project because Monterey Road would not be narrowed. Volume 2, Appendix 3.2-A, Table 11, presents the intersection effects for the Monterey Corridor Subsection during construction.

The four project alternatives would be different in the Morgan Hill and Gilroy Subsection. Alternative 1 would entail predominantly viaduct construction through the subsection, with all HSR track and systems grade-separated from existing transportation infrastructure. Limited closures of some roadways would be necessary to build this project alternative, including US 101 just south

of downtown Gilroy for one or a limited number of weekends. Of the four project alternatives, construction of the embankment for Alternative 2 would have the greatest effects. Reconstruction of existing transportation facilities would be necessary to implement this project alternative. New interchanges and overcrossings would be necessary at Bailey Avenue, Palm Avenue, Live Oak Avenue, Madrone Parkway, Monterey Road, Main Avenue, East Dunne Avenue, San Pedro Avenue, Tennant Avenue, East Middle Avenue, West San Martin Avenue, Church Avenue, Masten Avenue, Rucker Avenue, Buena Vista Avenue, Las Animas Avenue, Leavesley Road, East 6th Street, East 7th Street, East 9th Street and East 10th Street. In order to reconstruct these overcrossings and interchanges, either new temporary facilities would need to be built or the roadways would need to be closed. Under either approach, the temporary roadway detours and relocations would likely result in temporary increases in travel times, delay and inconvenience to the traveling public. Alternative 3 would be similar to Alternative 1 in that it would be fully grade-separated from existing and planned transportation infrastructure. However, Alternative 3 would be routed through east Gilroy rather than through downtown, thereby affecting fewer and less-traveled transportation facilities. The viaduct construction under Alternatives 1 and 3 would affect the roadways it crosses; however, it would not involve substantial reconstruction of the existing roadway infrastructure included under Alternative 2. Alternative 4 would build a blended at-grade system that runs through downtown Gilroy. New quad gates would be installed at Blanchard Road, Palm Avenue, Live Oak Avenue, Tilton Avenue, East Main Avenue, East Dunne Avenue, San Pedro Avenue, Tennant Avenue, East Middle Avenue, East San Martin Avenue, Church Avenue, Masten Avenue, Rucker Avenue, Buena Vista Avenue, Cohansey Avenue, Las Animas Avenue, Leavesley Road, IOOF Avenue, Lewis Street, Martin Avenue, East 6th Street, East 10th Street, Luchessa Avenue, and Bloomfield Road. In order to build these gates, temporary roadway detours and relocations would be required and would likely result in temporary increases in travel times, delay and inconvenience to the traveling public.

All four alternatives would require that Pacific Gas and Electric (PG&E) reinforce the electric power distribution network to meet HSR traction and distribution power requirements by replacing (reconductoring) approximately 11.1 miles of existing power line associated with the Spring to Llagas and Green Valley to Llagas 115-kilovolt power lines. The power lines to be reconductored would reuse the existing poles and towers, beginning at the Morgan Hill Substation on West Main Avenue in Morgan Hill, then crossing to the east side of Peak Avenue and Dewitt Avenue, spanning West Dunne Avenue, Chargin Drive, Spring Avenue, and several residences. The alignment would continue south across an open space area, then follow Sunnyside Avenue for approximately 0.5 mile. The alignment would continue south for approximately 4 miles, spanning active vineyards and the Corde Valle Golf Course. The alignment would then turn east along the north side of Day Road before heading south for approximately 2.5 miles and terminating at the Llagas Substation in Gilroy. Construction of these facilities would potentially require temporary roadway or lane closures, which would increase travel times and inconvenience the public.

In both the Pacheco Pass and San Joaquin Valley Subsections, the effects of the four project alternatives on existing and planned transportation infrastructure would be common across the alternatives. In the Pacheco Pass Subsection and San Joaquin Valley Subsection, the HSR alignment would be developed on the south side of SR 152 and Henry Miller Road, respectively. Major construction would include demolition and clearance of structures in the right-of-way, construction of temporary roads at new grade separations (shoofly), construction of new grade separations, MOIS, and placement of railbeds and HSR track and systems on at-grade and embankment sections. For all four alternatives, there would be four new grade separations at Mercey Springs Road, Delta Road, Turner Island Road, and Carlucci Road. These grade separations would each require approximately 2 to 2.5 years to construct, 6 months to relocate roads, 1.5 years to build the new road, and 2 to 6 months to remove the temporary road. The grade separations would relocate the existing road to the west of the current alignment for approximately 2 years. At these and other locations, the affected roadway would either be rerouted onto a temporary alignment or temporarily closed. Temporary closures would be viable if traffic volumes on the affected roadway were very low and a detour route was available that did not require an extraordinary amount of additional travel.

To reduce traffic conflicts caused by construction, the contractor will prepare a CTP (TR-IAMF#2). The CTP, which will be reviewed and approved by the Authority, will address, in detail, the activities to be carried out in each construction phase. The CTP will provide a traffic control plan that will identify when and where temporary closures and detours will occur, with the goal of maintaining traffic flow, especially during peak travel periods. The traffic control plan will be developed for each affected location and will include, at a minimum, signage to alert drivers to the construction zone, traffic control methods, traffic speed limitations, and alternative access and detour provisions during road closures. Any temporary closure or removal of parking areas or roadways during construction would be temporary and would be restored upon completion of construction. Efforts would be made to minimize their removal or shorten the length of time that these facilities are inoperable to the extent possible.

CEQA Conclusion

Construction of all four project alternatives would create temporary increases in automobile delay and travel time for the public. Under CEQA, automobile delay is not a significant environmental impact.

Impact TR#2: Temporary Congestion/Delay Consequences on Major Roadways, Freeways, and Intersections from Construction Vehicles

Construction work on stations, MOWF, platform, PG&E upgrades, and track alignment would result in construction traffic, including heavy truck traffic delivering and removing materials and heavy construction equipment moving onto the construction site. Use of heavy equipment and delivery or removal of materials by trucks have the potential to add to traffic congestion, especially if movements occur during morning or evening peak periods. Construction traffic would also result from construction worker trips. Worker vehicles entering and leaving the job sites at the beginning and end of shifts have the potential to increase delays on roadways and at intersections. Construction traffic would lead to interference with local vehicle circulation and operational hazards.

The construction traffic effects would be similar for all four project alternatives for the San Jose Diridon Station Approach, Monterey Corridor, Pacheco Pass, and San Joaquin Valley Subsections. In the Morgan Hill and Gilroy Subsection, the differences would be pronounced because of the different geographic alignments. Alternatives 1, 2, and 4 would route construction traffic through downtown Gilroy while Alternative 3 would focus this activity near the East Gilroy Station location, east of US 101.

Standard construction procedures related to traffic management will be used, including development of a CTP (TR-IAMF#2), which will be reviewed and approved by the Authority and will include details on the activities to be carried out during each construction phase, including construction vehicle operations. The CTP will implement a detailed traffic control plan for each affected location prior to beginning any construction activities. The CTP will identify when and where temporary closures and detours will occur, with the goal of maintaining traffic flow, especially during peak travel periods. At a minimum, the CTP will include temporary signage to alert drivers to the construction zone, personnel operating flags or other methods of traffic control, traffic speed limitations, identified construction traffic routes, and provisions to allow safe access to residences and business to reduce effects on major roadways from construction vehicle traffic.

All truck traffic, either for hauling spoil or for transporting construction materials to the site, will use the designated truck routes in each city (TR-IAMF#7) to the extent feasible. As part of the CTP, truck routes will be established away from schools, day care centers, and residences, or along the routes with the least effect to minimize operations hazards. A detailed construction access plan would be developed and implemented for the project prior to beginning any construction activities. The construction access plan would be reviewed by local city, county, and transit agencies. The movement of heavy construction equipment such as cranes, bulldozers, and dump trucks to and from the site would generally occur during off-peak hours on designated truck routes. Once on site, heavy construction equipment would remain there until its use for that job was completed, so that equipment would not be moved repeatedly to and from the construction site over public streets.

Trips for construction workers would generally occur outside of the peak hours for roadway and freeway traffic. The contractor will limit the number of construction employees arriving or departing the site between the hours of 7 a.m. and 8:30 a.m. and 4:30 p.m. and 6 p.m. (TR-IAMF#6). The contractor will also limit construction material deliveries between 7 a.m. and 9 a.m. and between 4 p.m. and 6 p.m. on weekdays to reduce traffic conflicts generated by construction traffic.

To facilitate truck and worker access to the project site during project construction, improvements would be made to an existing at-grade intersection on SR 152 in the Pacheco Pass Subsection. The intersection is 3.25 miles east of the Casa De Fruta overcrossing and currently provides access to agricultural parcels south of the highway. Existing traffic volumes at the tee-intersection are low; left and right turns in and out from the south are permitted. The southern (minor street) approach is controlled by a stop sign while eastbound and westbound traffic on the highway is not required to stop. The project proposes to improve the intersection by installing acceleration and deceleration lanes for vehicles entering and exiting the southerly access in both the eastbound and westbound directions for both left and right turning movements. Improvements to the intersection would be made in accordance with all Caltrans design standards regarding truck access to State highway facilities so that safe movements can be executed at this location during project construction.

Existing traffic volumes on SR 152 at the intersection are approximately 43,000 vehicles per day, with 4,300 vehicles traveling the highway during the peak commute hour. Following area commute patterns, travel in the westbound direction predominates in the morning peak hour with travel in the eastbound direction higher in the evening peak hour. The signed speed limit on this section of SR 152 is 55 miles per hour as it moves through moderately rolling terrain with large horizontal curves.

The intersection would be used for access by project construction vehicles for approximately eight years. During the peak periods of project construction, approximately 50 truck trips and 330 vehicle trips by HSR workers are expected to use the improved intersection on a daily basis. In this context, a trip represents either an inbound or an outbound movement (i.e., a truck traveling to and from the project site making a delivery would represent two trips). In the peak hour during these peak construction periods, roughly five truck trips and 160 worker trips would use the intersection.

While the operations of ambient traffic on SR 152 would remain largely unimpeded during these periods of project construction (traffic on SR 152 is not required to stop at the intersection), peak hour delays for project construction vehicles entering and exiting the site would be high. During the morning and evening peak hours, the LOS for construction vehicles entering SR 152 would be F, with high levels of vehicle delay. The right turn-in movement from the west would function well with vehicles entering the site unimpeded. The left turn-in movement from the east would operate at LOS E/F for construction vehicles seeking to enter the site from the east. Sufficient gaps in traffic do not exist at this location during peak commute hours because of the high levels of eastbound and westbound traffic on SR 152.

During peak periods when the left turn-out movement is difficult to make because of a lack in gaps in traffic, the alternative is for vehicles to make a right turn onto SR 152 with a subsequent downstream U-turn to complete travel to the west. The nearest location for this to occur safely is at the Santa Nella Road/SR 152 interchange located approximately 22 miles to the east. For vehicles turning left into the site from the east, the nearest downstream turn around for a safe U-turn is at the Casa De Fruta/SR 152 interchange 3.25 miles to the west.

This temporary effect during construction would not adversely affect travel for the public, as the only vehicles that would be meaningfully delayed would be project-related construction traffic. Nevertheless, to facilitate efficient ingress and egress, project-related construction traffic should be directed to occur outside of peak periods to the extent possible, consistent with TR-IAMF#7.

CEQA Conclusion

Construction of all four project alternatives would involve temporary construction vehicle operations that would interfere with local vehicle circulation resulting in delays or reductions in peak hour LOS operations. Under CEQA, automobile delay is not a significant environmental impact. Project features include actions to control and manage construction vehicle traffic through implementation of traffic control plans for each affected location prior to beginning construction activities, which will include efforts to minimize effects on major roadways from construction vehicle traffic through signage to alert drivers, traffic control methods, construction traffic routes, and alternative access and detour provisions. In addition, construction worker trips and material deliveries would be limited to off-peak hours for roadway and freeway traffic.

Impact TR#3: Permanent Delay/Congestion Consequences on Freeways and Roadways from Permanent Road Closures and Relocations

Permanent roadway closures and roadway modifications associated with project construction would cause shifts in travel patterns. Decreased capacity at key intersections and roadways, particularly on Monterey Road, would cause trips to shift from surface streets to freeways or other parallel roadway facilities. The additional freeway traffic caused by the permanent construction changes would lead to a degradation of LOS and increased congestion on freeway segments. The effects of these permanent closures were studied under the Existing Plus Project conditions. Impact TR#7: Continuous Permanent Delay/Congestion Consequences on Freeway Operations describes quantitative freeway effects in 2029 and 2040 from construction and operation activities, which were analyzed together as part of the operations analysis.[15]

Project construction would require changes and closures to be made throughout the roadway network to accommodate the stations, platforms, track alignment, and MOWFs. Table 3.2-14 presents the permanent roadway network changes and closures proposed by each project alternative. The types of roadway modifications, similar under all four alternatives, would include road closures, road narrowing, road realignment, and modified or new grade separations. Modifications unique to Alternative 4 would include the installation of quad gates around at-grade rail crossings. Alternative 1 would require permanent closure of 18 roadways, and relocation or modification of 27 roadways. Alternative 2 would require the most permanent road closures and roadway modifications, including 30 permanent road closures, and relocation or modification of 59 roadways. Alternative 3 would require permanent road closure of 17 roadways, and relocation or modification of 32 roadways. Alternative 4 would require 15 permanent road closures and the relocation or modification of 39 roadways.

Table 3.2-14 Permanent Roadway Closures and Changes by Subsection and Alternative

Roadway	Type of Change	Description of Change	Alternative			
			1	2	3	4
San Jose Diridon Station Approach						
Grant St	Other roadway modification	Shorten road		X	X	
De la Cruz Blvd	Grade separation	Change from overcrossing to undercrossing		X	X	
West Hedding St	Other roadway change	Rebuild existing overcrossing	X			
West Hedding St	Grade separation	Change from overcrossing to undercrossing		X	X	
Stockton Ave	Road closure	Convert to a cul-de-sac	X	X	X	

[15] Impacts from construction activities are described qualitatively for 2029 and 2040 under Construction Impacts, while combined impacts from construction and operations are described quantitatively under Operations Impacts.

Roadway	Type of Change	Description of Change	Alternative			
			1	2	3	4
University Ave	Road closure	Convert to a cul-de-sac	X	X	X	
Emory St	Road closure	Convert to a cul-de-sac	X	X	X	
Chestnut St	Road closure	Realign; close from Asbury St to W Taylor St	X	X	X	
West Taylor St	Grade separation	Build new HSR undercrossing (Caltrain railroad bridge over Taylor is maintained)	X			
West Taylor St	Grade separation	Build new HSR overcrossing alongside existing Caltrain overcrossing				X
West Taylor St	Alignment change	Realign westbound Taylor St to northbound Chestnut St		X	X	
North Montgomery St	Other roadway change	Extend to maintain property access	X	X	X	
Stover St	Other roadway change	Extend Stover St from S Montgomery St to Autumn St	X	X	X	
Crandall St	Other roadway change	Extend from S Montgomery St to Autumn St	X	X	X	
Cahill St	Other roadway change	Extend to Park Ave and convert lanes to transit only	X	X	X	
Cahill St	Other roadway change	Extend to Otterson; convert to transit only lanes				X
Bird Ave	Other roadway change	Rebuild existing underpasses				X
Delmas Ave	Other roadway change	Rebuild existing underpasses				X
SR 87 on-ramp	Alignment change	Realign ramp	X	X	X	
Auzerais Ave	Install quad gates	Install quad gates across Auzerais Ave at rail crossing				X
W Virginia St	Install quad gates	Install quad gates across W Virginia St at rail crossing				X
Fuller Ave	Alignment change	Realign Fuller Ave cul-de-sac				X
Monterey Corridor						
Almaden Expwy	Alignment change	Realign on-ramp to SR 87	X		X	
Curtner Ave	Other roadway change	Rebuild overpass	X	X	X	
Monterey Rd between Capitol Expwy and Blossom Hill Rd	Lane narrowing	Narrow Monterey Rd to four lanes	X	X	X	

Roadway	Type of Change	Description of Change	Alternative			
			1	2	3	4
Monterey Rd	Other roadway change/Alignment change	Widen road for bus turnout; realign road	X		X	
Monterey Rd	Other roadway change	Close midblock SB left turn into shopping center between Senter and Skyway	X	X	X	
Skyway Drive	Grade separation	Depress Skyway Drive and realign with ramp return to Monterey Rd		X		
Skyway Drive	Install quad gates	Install quad gates across Skyway Drive at Monterey Rd				X
Branham Lane	Grade separation	Reconfigure intersection; depress Monterey Rd; remove some turn lanes		X		
Branham Lane	Install quad gates	Install quad gates across Branham Lane at Monterey Rd				X
Rice Way	Road closure	Close access from Rice Wy to Monterey Rd		X		
Waterfall Court	Other roadway change	Extend Waterfall Ct to Broken Lance Ct		X		
Waterfall Court	Road closure	Close access from Waterfall Ct to Chynoweth		X		
Chynoweth Ave	Grade separation	Reconfigure roadway; remove some turn lanes		X		
Chynoweth Ave	Install quad gates	Install quad gates across Chynoweth Ave at Monterey Rd				X
Monterey Rd	Other roadway change	Close midblock SB left turn into shopping center between Chynoweth Ave and Blossom Hill Rd	X	X	X	
Blossom Hill Rd SB Ramp from Monterey Rd to Blossom Hill	Other roadway change	Reconfigure ramps: Move SB on-ramp to other side of Monterey, access via SB lane pocket		X		
Flintwell Way	Road widening	Widen Monterey Rd at Flintwell Way	X		X	
Monterey Rd	Other roadway change	Remove southbound left turn lane into Hicks Lane	X		X	
Bernal Rd	Road widening	Widen of on-/off-ramps to Monterey Rd	X		X	
Great Oaks Pkwy	Alignment change	Realign Great Oaks Pkwy				X
Morgan Hill and Gilroy						
Monterey Rd	Other roadway change	Remove SB midblock left turn into Roding Way	X	X	X	
Monterey Rd	Other roadway change	Close left turns in and out of Forsum Rd			X	
Monterey Rd	Road widening	Widen from Metcalf Rd to Coyote Ranch Rd	X		X	
Blanchard Rd	Road closure	Close road		X		

Roadway	Type of Change	Description of Change	Alternative			
			1	2	3	4
Blanchard Rd	Other roadway change	Extend Blanchard Rd to new Emado Ave extension		X		
Blanchard Rd	Install quad gates	Install quad gates across Blanchard Rd at Monterey Rd				X
Monterey Rd	Alignment change	Realign from Blanchard Rd to Cochrane Rd		X		
Emado Rd	Road closure	Close road		X		X
Emado Rd	Other roadway change	Extend Emado Rd to Santa Teresa		X		
Charter Access Rd	Alignment change	Realign access road to charter school		X		
Richmond Ave	Road closure	Convert to cul-de-sac; widen road by adding shoulders				X
Bailey Ave	Alignment change	Realign ramps		X		
Fox Lane	Road closure	Close road		X		X
Fox Lane	Other roadway change	New Fox Court north of closed Fox Lane; new roadway would extend from Dougherty Ave		X		X
Palm Ave	Other roadway change	Remove designated left turn from SB Monterey Rd	X			
Palm Ave	Grade separation	Depress Palm Ave and realign to access Monterey Rd from opposite side of roadway		X		
Palm Ave	Install quad gates	Install quad gates across Palm Ave at Monterey Rd				X
Monterey Rd near Ogier	Alignment change	Realign with dogleg	X			
Ogier	Road Closure	Closure of a segment of Ogier.	X		X	
Live Oak Ave	Grade separation	Realign Live Oak Ave to access Monterey Rd from opposite side of roadway		X		
Live Oak Ave	Install quad gates	Install quad gates across Live Oak Ave at Monterey Rd				X
Tilton Ave	Road closure	Close road		X		
Tilton Ave	Install quad gates	Install quad gates across Tilton Ave at Monterey Rd				X
Monterey Rd	Other roadway change	Rebuild existing Monterey Rd underpasses				X
Madrone Pkwy	Grade separation	Realign Madrone Pkwy to access Monterey Rd from opposite side of roadway; extend roadway to new intersection at Hale Ave		X		
Monterey Rd	Alignment change	Realign Monterey Rd	X	X		
East Central Ave	Road closure	Realign East Central Ave cul-de-sac to the east		X		

Roadway	Type of Change	Description of Change	Alternative			
			1	2	3	4
East Main Ave	Grade separation	Widen and modify road; no changes to Monterey Rd access		X		
East Main Ave	Install quad gates	Install quad gates across East Main Ave				X
Depot St	Road closure	Close access from Depot St to Main Ave due to grade separation		X		
Diana Ave	Road closure	Relocate Diana Ave cul-de-sac to the east		X		X
St. Agatha Lane	Road closure	Closure of cul-de-sac		X		
East Dunne Ave	Grade separation	Widen and modify road; no changes to Monterey Rd access		X		
East Dunne Ave	Install quad gates	Install quad gates across East Dunne Ave				X
San Pedro Ave	Road closure	Relocate cul-de-sac to west of HSR	X		X	
San Pedro Ave	Grade separation	Rebuild San Pedro Ave; no changes to Monterey Rd access		X		
San Pedro Ave	Install quad gates	Install quad gates across San Pedro Ave				X
Railroad Ave	Alignment change	Modify and realign Railroad Ave roadway between Barrett Ave and Maple Ave		X		
Barrett Ave	Alignment change	Realign access to Saint John Court	X		X	
Tennant Ave	Grade separation	Build new underpass along Tennant; realign roadway; replace Railroad Ave with new frontage road that provides access to Barrett Ave and Maple Ave		X		
Tennant Ave	Install quad gates	Install quad gates across Tennant Ave				X
Fisher Ave	Road closure	Close and relocate cul-de-sac to west of HSR	X		X	
Caputo Drive	Road closure	Close off Caputo Dr. access to Tennant Ave and convert to a cul-de-sac		X		
East Middle Ave	Grade separation	Realign grade separation		X		
East Middle Ave	Install quad gates	Install quad gates across East Middle Ave				X
Monterey Rd	Other roadway change	Provide midblock SB left turn 450 feet north of Carl Court		X		
Monterey Rd	Alignment change	Realign from East Middle Ave to San Martin Ave; build new bridge over Llagas Creek		X		
Colony Ave	Alignment change	Connect Colony Ave to San Martin Ave		X		
Oak St	Grade separation	Rebuild Oak St; no changes to access on Monterey Rd		X		

Roadway	Type of Change	Description of Change	Alternative			
			1	2	3	4
East San Martin St	Grade separation	Build new underpass; realign and rebuild road; convert access to Monterey Rd to T-intersection and shift to west side of roadway; provide new access onto East San Martin St from Colony Ave and Llagas Ave		X		
East San Martin St	Install quad gates	Install quad gates across East San Martin St at Monterey Rd				X
Lincoln Ave	Road closure	Convert Lincoln Ave to cul-de-sac south of realigned San Martin Ave		X		
South St	Other roadway change	Shorten South St	X		X	
Church Ave	Grade separation	Realign Church Ave to access Monterey Rd from opposite side of roadway		X		
Church Ave	Install quad gates	Install quad gates and new traffic signal across Church Ave at Monterey Rd				X
Lena Ave	Road closure	Convert Lena Ave to a cul-de-sac		X		
Masten Ave/Fitzgerald Ave	Grade separation	Depress Monterey Rd; realign Masten Ave and Fitzgerald Ave to access Monterey Rd		X		
Masten Ave/Fitzgerald Ave	Install quad gates	Install quad gates across Masten Ave at Monterey Rd				X
Rucker Ave	Grade separation	Realign Rucker Ave to access Monterey Rd from opposite side of roadway		X		
Rucker Ave	Install quad gates	Install quad gates and new traffic signal across Rucker Ave at Monterey Rd				X
Monterey Rd	Other roadway change	Depress roadway to conform with Buena Vista Ave grade separation		X		
Denio Ave	Road closure	Convert Denio Ave to a cul-de-sac		X		
Buena Vista Ave	Grade separation	Build new underpass; realign and widen road; T-intersection with realigned Monterey Rd on west side of existing Monterey road alignment		X		
Buena Vista Ave	Install quad gates	Install quad gates and new traffic signal across Buena Vista Ave at Monterey Rd				X
Cohansey Ave	Road closure	Close road			X	
Cohansey Ave	Alignment change	Realign to merge with Las Animas Ave		X		
Cohansey Ave	Install quad gates	Install quad gates and new traffic signal across Cohansey Ave at Monterey Rd				X
Farrell Ave	Alignment change	Realign to merge with Las Animas Ave and Cohansey Ave		X		

Roadway	Type of Change	Description of Change	Alternative			
			1	2	3	4
Las Animas Ave	Grade separation	Realign to merge with Cohansey Ave		X	X	
Las Animas Ave	Install quad gates	Install quad gates across Las Animas Ave at Monterey Rd				X
Marcella Ave	Other roadway change	Build new road north and parallel to Leavesley Rd to connect the station to Marcella Ave			X	
New road north of Leavesley Rd	Other roadway change	Build new road north and parallel to Leavesley Rd west of HSR			X	
New road parallel to Marcella Ave	Other roadway change	Build new road parallel to Marcella Ave connecting Leavesley Rd to Las Animas, adjacent to Gilroy outlets			X	
Leavesley Rd	Grade separation	Build new underpass		X		
Leavesley Rd	Grade separation	Build new overpass			X	
Leavesley Rd	Install quad gates	Install quad gates across Leavesley Rd at Monterey Rd				X
Casey St	Grade separation	Build new underpass		X		
Wheeler St	Road closure	Shorten and convert to a cul-de-sac		X		
IOOF Ave	Grade separation	Build new underpass; demolish existing bridge		X		
IOOF Ave	Install quad gates	Install quad gates across IOOF Ave at Monterey Rd				X
Lewis St	Grade separation	New underpass		X		
Lewis St	Install quad gates	Install quad gates across Lewis St at Monterey Rd				X
Martin St	Road closure	Close road		X		
Martin St	Install quad gates	Install quad gates across Martin St at Monterey Rd				X
Railroad St	Road closure	Close road	X	X		X
East 6th St	Other roadway change	Build new underpass		X		
East 6th St	Install quad gates	Install quad gates across East 6th St at Monterey Rd				X
East 6th St	Alignment change	Realign		X		
Gilman Ave	Grade separation	Rebuild Gilman Ave over HSR tracks			X	
Old Gilroy St	Road closure	Close road at realigned 7th St	X			X
Old Gilroy St	Grade separation	Build new underpass along East 7th St; sever access to Railroad St, which becomes an HSR access road		X		
East 7th St	Alignment change	Realign and extend to Alexander St	X	X		
East 7th St	Road closure	Close road				X

Roadway	Type of Change	Description of Change	Alternative			
			1	2	3	4
East 9th St	Grade separation	Build new underpass; extend road to connect from Alexander St to Monterey Rd		X		
East 10th St	Grade separation	Build new underpass		X		
East 10th St	Install quad gates	Install quad gates across East 10th St at Monterey Road				X
Sheldon Ave	Road closure	South side to cul-de-sac; south side abandoned.	X	X		
Banes Lane	Other roadway change	Extend for access to new parking and cul-de-sac for access to system site	X	X		X
East Luchessa Ave	Install quad gates	Install quad gates across East Luchessa Ave at Monterey Rd				X
Bloomfield Rd	Grade separation	Build new overpass; realign road; build new roads from Bloomfield for access to maintenance facility and systems site	X	X		
Bloomfield Rd	Install quad gates	Install quad gates across Bloomfield Rd				X
Holsclaw Rd	Road closure	Close road			X	
Holsclaw Rd	Alignment change	Realign to connect with SR 152 grade separation			X	
Frazier Rd	Grade separation	Build new overpass	X	X		
SR 152	Grade separation	Build new overpass; realign road; provide on-ramp access from existing Holsclaw Rd and Frazier Lake Rd			X	
Carnadero Ave	Road closure	Close road closure				X
Frazier Lake Rd	Grade separation	Rebuild intersection with SR 152 and reconfigure to maintain access			X	
SR 152/Pacheco Pass Hwy	Road widening	Widen road; build additional turn-out and transition lane on westbound SR 152 and additional left turn lane and transition lane on eastbound SR 152 (additional lanes provide queueing space for vehicles going from SR 152 to TPSS site)	X	X	X	X
Pacheco Pass						
N Romero Rd	Alignment change	Realign N Romero Rd	X	X	X	X
San Joaquin Valley						
Fahey Rd	Alignment change	Realign Fahey Rd	X	X	X	X
Volta Rd	Road closure	Realign intersection and close roadway to the north of Henry Miller Rd	X	X	X	X
Henry Miller Rd	Grade separation	Realign road near Volta Rd	X	X	X	X
Henry Miller Rd	Other roadway change	Build new road from Badger Flat Rd to Nantes Ave along south of HSR	X	X	X	X

Roadway	Type of Change	Description of Change	Alternative			
			1	2	3	4
Johnson Rd	Road closure	Close road	X	X	X	X
Nantes Ave	Road closure	Close road	X	X	X	X
Mercey Springs Rd	Grade separation	Rebuild intersection as grade-separated and realign to access Henry Miller Rd as T-intersection	X	X	X	X
Santa Fe Grade	Road closure	Close road	X	X	X	X
Baker Rd	Road closure	Close road	X	X	X	X
Midway Rd	Road closure	Close road	X	X	X	X
Box Car Rd	Road closure	Close road	X	X	X	X
Delta Rd	Grade separation	Rebuild intersection as grade-separated and realign to access Henry Miller Rd as T-intersection	X	X	X	X
Turner Island Rd	Grade separation	Rebuild intersection as grade-separated and realign to access Henry Miller Rd as T-intersection	X	X	X	X
Hutchins Rd	Road closure	Close road	X	X	X	X
Carlucci Rd	Grade separation	Build new grade separation; reconfigure intersection access to Henry Miller Rd	X	X	X	X

Source: Authority 2019a
I = interstate
SR = state route
SB = southbound
HSR = high-speed rail

All alternatives would be constructed in accordance with applicable engineering design standards. Transportation network modifications, including roadway closures and modifications would not substantially increase hazards because of a design feature (such as sharp curves or dangerous intersections) or the introduction of an incompatible use, as discussed further in Section 3.11, Safety and Security.

Across all alternatives, most road closures would occur in unincorporated Merced County along Henry Miller Road, which would be rebuilt with a number of new grade-separated roadways and eight road closures under each alternative. Roadway modifications and realignments would be distributed along the length of the alternatives. There would be no closures or changes to any public roads in Pacheco Pass.

Alternative 1 would construct a viaduct to downtown Gilroy. On Monterey Road, the viaduct would run down the median of the roadway, resulting in a road diet and expansion of the raised center median to accommodate the additional space required by the viaduct structure. This road diet would reduce through lanes from six lanes to four between Southside Drive and Bernal Way and close a number of turn pockets. The viaduct would continue through Morgan Hill and Gilroy, resulting in closure of a midblock left turn lane on Monterey Road and the closure of Railroad Street near the Downtown Gilroy Station.

Alternative 2 would construct an embankment to downtown Gilroy. The alignment would be constructed between Monterey Road and the existing UPRR tracks. This alternative would reconstruct Monterey Road to shift the right-of-way to the east. Monterey Road would be narrowed at the same places as Alternative 1 but would have more turn pocket closures. Under this project alternative, the southbound on-ramp from Monterey Road to Blossom Hill Road would be removed and reconstructed on the east side of the roadway. The embankment would continue through Morgan Hill and Gilroy along Monterey Road. A large number of grade separations and

intersection reconfigurations would be built in Morgan Hill, San Martin, and Gilroy. Five minor streets would also be closed and traffic redirected to parallel local routes. The roadway changes around the Downtown Gilroy Station would be the same as Alternative 1, except that the extension of 9th Street through the station area from Monterey Road to Alexander Street would not be built under Alternative 2.

Alternative 3 would construct a viaduct east of Gilroy. The roadway changes to Monterey Road and through most of Morgan Hill and Gilroy would be identical to Alternative 1. There would be no changes around the existing Downtown Gilroy Station because the HSR station would be in east Gilroy. The changes to the roadway network in east Gilroy would include two local road closures and four new roadway grade separations.

Alternative 4 would be built at grade to downtown Gilroy. The alignment would be built as a blended system with two electrified tracks for HSR and Caltrain and a separate non-electrified track for freight and other passenger services. The alternative would construct pick-up and drop-off spaces throughout the San Jose Diridon Station area that would differ from Alternatives 1, 2, and 3, and it would not include the extension of Cahill Road through to Park Avenue. The alternative would not narrow Monterey Road as would occur under the other alternatives. New quad gates would be installed at all at-grade rail crossings. The roadway changes around the Downtown Gilroy Station would be the same as Alternative 1, except for the extension of 9th Street through the station area from Monterey Road to Alexander Street, which would not be built under Alternative 4. Access to a parking lot off Alexander Street would be provided on Alexander Street and Chestnut Street, while Alternatives 1 and 2 would only provide access from Alexander Street.

The Authority studied the effects of these permanent closures under the Existing Plus Project conditions. Of the 20 freeway segments studied in the RSA, six segments would operate at LOS E or F under the Existing Plus Project conditions under Alternatives 1, 2, and 3. Two of the freeway segments, on US 101 between the lane drop north of Masten Avenue and SR 85 and from SR 85 to Bernal Road, would have a V/C ratio of more than 0.04 over the existing conditions and would therefore be affected by the project. The increase in vehicle traffic on the freeway would be due to diversion of traffic away from the reduction of capacity on Monterey Road with Alternatives 1, 2, and 3. No freeway segments would be affected by Alternative 4, because this alternative would not reduce capacity on Monterey Road. Volume 2, Appendix 3.2-A, Table 12, shows the results for the Existing Plus Project freeway LOS.

CEQA Conclusion

Changes to the geometry and capacity of roadways (as shown in Table 3.2-14) under Alternatives 1, 2, and 3 in the Existing Plus Project conditions would increase automobile delays on freeway segments in the Monterey Corridor Subsection. These delays would not occur under Alternative 4. Under CEQA, automobile delay is not a significant environmental impact.

Impact TR#4: Permanent Delay/Congestion Consequences on Intersections from Permanent Road Changes

Project construction would require changes and closures throughout the roadway network to accommodate the stations, platforms, track alignment, and MOWFs. The locations of permanent road closures and relocations are described in Impact TR#3: Permanent Delay/Congestion Consequences on Freeways and Roadways from Permanent Road Closures and Relocations. Volume 2, Appendix 3.2-A, Table 12, presents the results for Existing Plus Project LOS at intersections by subsection. Intersections would be affected by the project if operations were to degrade to LOS E or F and result in an increase in average traffic delay of 4 or more seconds for signalized intersections and 5 seconds or more for unsignalized intersections, over the baseline condition.

In the San Jose Diridon Station Approach Subsection, the permanent closures and modifications to the roadway network would result in some shifting of traffic, but there would be no changes to the capacity of modified roadways. In this subsection, none of the 50 intersections studied would operate at LOS E or F.

In the Monterey Corridor Subsection, the effects of permanent road changes are more pronounced. The road diet on Monterey Road would reduce capacity on the corridor, creating increased congestion and delays on Monterey Road that would shift traffic to the surrounding roadway network. For Alternatives 1 and 3, 17 out of 46 intersections studied would operate at LOS E or F, and 13 of these intersections would be affected by the project. For Alternative 2, 16 out of 46 intersections studied would operate at LOS E or F, and 12 of these intersections would be affected by the project. For Alternative 4, 11 of 46 intersections studied would operate at LOS E or F, but none of these intersections would be affected by the project. Alternative 4 would have fewer effects because Monterey Road would not be narrowed. Alternative 2 would have fewer effects than Alternatives 1 and 3 because of lower volumes at key intersections where traffic would be diverted by the removal of turn lanes. Under Alternative 2, both Skyway Drive Variants A and B were studied. Variant A would connect Skyway Drive to Monterey Road with a connector ramp to create a three-leg intersection, while Variant B would connect Monterey Road to Skyway Drive to create a four-leg intersection. Variant A would have higher intersection delays than Variant B.

In the Morgan Hill and Gilroy Subsection, there would be changes to the roadway network under Alternatives 2 and 4. Under Alternative 1, four of the 101 intersections studied would operate at LOS E or F, and one of these intersections would be affected by the project. Under Alternative 2, seven intersections would operate at LOS E or F and four of those intersections would be affected by the project. Under Alternative 3, four intersections would operate at LOS E or F and one would be affected by the project. Under Alternative 4, six intersections would operate at LOS E or F and two would be affected by the project.

No major physical changes would occur to the roadway network in the Pacheco Pass Subsection; therefore, effects on intersections were not analyzed for this subsection. In the San Joaquin Valley Subsection, one existing intersection, SR 165 and Henry Miller Road, would be affected by the project, but it does not currently operate at LOS E or F. The project would rebuild the intersection under all four project alternatives and would build a new intersection, but the LOS would not degrade to E or F.

CEQA Conclusion

The changes to the geometry and capacity of intersections under Alternatives 1, 2, and 3 would result in automobile delay. These delays would not occur under Alternative 4. Automobile delay is not a significant impact under CEQA.

Operations Impacts

The project would be fully operational in 2029 and 2040, with trains servicing passengers at San Jose Diridon Station and the Gilroy station. Trains would be maintained at the Gilroy MOWF. Passengers traveling to the station areas and maintenance workers traveling to MOWFs in vehicles would add vehicle trips to the roadway network. Chapter 2, Alternatives, describes the project's operations and maintenance activities.

Vehicle trips around the stations would increase because of the addition of passengers and HSR workers traveling to station areas. Many of these trips would occur during peak hours. In 2029, the project would generate approximately 400 peak hour vehicle trips at San Jose Diridon Station, approximately 360 peak hour vehicle trips at the Downtown Gilroy Station, and approximately 410 peak hour vehicle trips at the East Gilroy Station. In 2040, the project would generate approximately 1,100 peak hour vehicle trips at San Jose Diridon Station, approximately 690 peak hour vehicle trips at the Downtown Gilroy Station, and approximately 750 peak hour trips at the East Gilroy Station. This added traffic combined with traffic shifts caused by the Monterey Road lane reduction in Alternatives 1, 2, and 3, and delays from gate down time in Alternative 4 would lead to increased volume, congestion, and delays on freeways and at intersections.

Impact TR#5: Continuous Permanent Impacts on Vehicle Miles Traveled

When operational, the HSR system would divert vehicle trips from airports and other intercity travel hubs and would shift vehicle trips to train trips. This diversion of trips, even with the addition of new trips at the stations and maintenance facilities, would change regional and statewide travel

patterns. Overall, the impacts of these shifts and changes would reduce VMT. In 2029, the annual total No Project VMT in Santa Clara County would be 12.186 billion miles and the annual With Project VMT would be 12.027 billion miles, a reduction of 159 million miles. In San Benito County, the annual interregional No Project VMT would be 733 million miles and the annual With Project VMT would be 633 million miles, a reduction of 99 million miles. In Merced County, the annual interregional No Project VMT would be 1.507 billion miles and the annual With Project VMT would be 1.381 billion miles, a reduction of 125 million miles. In 2040, the annual total No Project VMT in Santa Clara County would be 13.201 billion miles and the annual With Project VMT would be 12.972 billion miles, a reduction of 230 million miles. In San Benito County, the annual interregional No Project VMT would be 846 million miles and the annual With Project VMT would be 676 million miles, a reduction of 170 million miles. In Merced County, the annual interregional No Project VMT would be 1,842 billion miles and the annual With Project VMT would be 1.642 billion, a reduction of 200 million miles. This reduction in VMT would be the same for all four project alternatives, as ridership and trip diversion associated with the project alternatives would be the same. For the 2029 and 2040 Plus Project conditions, vehicle trips around the stations would increase because of the addition of passengers and HSR workers traveling to station areas. The impacts at the stations would be offset by the overall decrease in VMT throughout the region and the state.

CEQA Conclusion

The impact under CEQA would be less than significant for all four project alternatives because the 2029 and 2040 Plus Project conditions would not result in a net increase of VMT over the baseline condition. The project would result in an overall decrease in VMT throughout the region and the state, resulting in a beneficial impact on VMT. The project would also be fully consistent with CEQA Guidelines Section 15064.3. Therefore, CEQA does not require mitigation.

Impact TR#6: Continuous Permanent Delay/Congestion Consequences on Freeway Operations

The 2029 and 2040 Plus Project conditions are presented in Volume 2, Appendix 3.2-A, Tables 4 and 6, respectively. High demand volumes in 2029 and 2040 under Plus Project conditions would result in increased congestion and a degradation of LOS. Project traffic and traffic shifted from the Monterey Road road diet would degrade LOS on some segments.

Under Alternatives 1, 2, and 3, two northbound segments along US 101 in the Monterey Corridor Subsection in southern San Jose would be affected in the AM peak hour under 2029 Plus Project conditions. The first segment, at the southbound lane drop north of Masten Avenue to SR 85, would experience an increase in the V/C ratio from 0.98 to 1.04 under 2029 Plus Project conditions compared to the 2029 No Project conditions. The second segment, at SR 85 to Bernal Road, would experience an increase in the V/C ratio from 1.19 to 1.23. Both segments would operate at LOS F under the 2029 No Project conditions and would remain at a LOS F under the 2029 Plus Project conditions. Under Alternative 4, no freeway segments studied would be affected under 2029 Plus Project conditions. Additional delays from gate down time at the at-grade crossings would shift traffic to US 101, but would not substantially degrade the LOS on any freeway segments.

Under Alternatives 1, 2, and 3, two northbound segments along US 101 in the Monterey Corridor Subsection in southern San Jose would be affected in the AM peak hour under 2040 Plus Project conditions. The first segment, at the southbound lane drop to SR 85, would experience an increase in the V/C ratio from 1.01 to 1.07 under 2040 Plus Project conditions compared to the 2040 No Project conditions. The second segment, at SR 85 to Bernal Road, would experience an increase in the V/C ratio from 1.24 to 1.29 under 2040 Plus Project conditions compared to the 2040 No Project conditions. Both segments would operate at a LOS F under the No Project conditions and would remain at a LOS F under the 2040 Plus Project conditions. Under Alternative 4, no freeway segments studied would be affected under 2040 Plus Project conditions. Additional delays from gate down time at the at-grade crossings would shift traffic to US 101, but would not substantially degrade the LOS on any freeway segments.

CEQA Conclusion

Alternatives 1, 2, and 3 would increase automobile delays for two segments of US 101 in the Monterey Corridor Subsection in southern San Jose. The permanent reduction in traffic lanes on Monterey Road would redistribute traffic, resulting in degradation of LOS and an increase in the V/C ratio over No Project conditions on segments of US 101. These delays would not occur under Alternative 4 to the same degree, if at all, because Monterey Road would not experience lane reductions that would cause traffic redistribution to result in LOS degradation or an increase in the V/C ratio. Automobile delay is not a significant impact under CEQA.

Impact TR#7: Continuous Permanent Delay/Congestion Consequences on Intersection Operations

Intersection LOS by subsection under 2029 No Project and 2029 Plus Project conditions are presented in Volume 2, Appendix 3.2-A, Tables 14 and 16 respectively. Under 2029 Plus Project conditions in the San Jose Diridon Station Approach Subsection, 19 intersections would operate at LOS E or F and 14 of these intersections would be affected by the project under Alternatives 1, 2, and 3. All 14 affected intersections would experience effects in the AM peak hour, while only 9 of these intersections experience effects in the PM peak hour. Under Alternative 4, 19 intersections would operate at LOS E or F and 9 of these intersections would be affected by the project. LOS was calculated using the weighted average of delay of all movements of an intersection. Therefore, when fewer trips are added to a movement that is already experiencing high delay, it is more likely to cause a degradation in LOS than when more trips are added to a movement that is experiencing lower delay. Although more intersections operate at LOS E or F in the PM peak hour, project trips would be added to movements experiencing high delay at more intersections in the AM peak hour. Although there are fewer affected intersections under Alternative 4 in the San Jose Diridon Station Approach Subsection, there would be more substantial effects at the at-grade crossings and on Autumn Boulevard and Montgomery Street in the station area from additional gate down time at the at-grade crossings and the absence of the Cahill Street extension to Park Avenue.

Intersection effects by subsection under 2040 No Project and 2040 Plus Project conditions are presented in Volume 2, Appendix 3.2-A, Tables 14 and 16 respectively. Under 2040 No Project conditions, 26 intersections would operate at LOS E or F. Under 2040 Plus Project conditions in the San Jose Diridon Station Approach Subsection, 26 intersections would operate at LOS E or F and 16 of these intersections would be affected by the project under Alternatives 1, 2, and 3. Under Alternative 4, 25 intersections in this subsection would operate at LOS E or F and 11 of these intersections would be affected by the project.

In 2029 No Project conditions in the Monterey Corridor Subsection, 20 intersections would operate at LOS E or F. 2029 Plus Project conditions in the Monterey Corridor Subsection under Alternatives 1 and 3, 29 intersections would operate at LOS E or F and 23 of these intersections would be affected by the project. Under Alternative 2, 28 intersections would operate at LOS E or F, and 23 of those intersections would be affected by the project. This high level of congestion is due to the high demand volumes throughout this corridor and constrained roadway choice. Under Alternative 2, both Skyway Drive Variants A and B were studied. Variant A would connect Skyway Drive to Monterey Road with a connector ramp that would create a three-leg intersection, while Variant B would connect Monterey Road to Skyway Drive with a four-leg intersection. Both variants would operate at LOS F in both peak hours, although Variant A would have higher intersection delays than Variant B. Under Alternative 4, 24 intersections would operate at LOS E or F and 5 of those intersections would be affected by the project. Alternative 4 would cause fewer effects than the other alternatives in this subsection because it would not reduce lane capacity on Monterey Road.

In 2040 No Project conditions in the Monterey Corridor Subsection, 30 intersections would operate at LOS E or F. In 2040 Plus Project conditions in the Monterey Corridor Subsection under Alternatives 1 and 3, 32 intersections would operate at LOS E or F and 25 of these intersections would be affected by the project. Under Alternative 2, 31 intersections would operate at LOS E or F, and 26 of those intersections would be affected by the project. The same configurations under

Alternative 2 for Skyway Drive Variant A and B were studied in the 2040 Plus Project conditions; both variants would operate as LOS F during both peak hours. Under Alternative 4, 33 intersections would operate at LOS E or F and 5 of those intersections would be affected by the project. As in 2029, Alternative 4 would have fewer effects than the other alternatives in this subsection because it would not reduce lane capacity on Monterey Road.

In the 2029 Plus Project conditions in the Morgan Hill and Gilroy Subsection under Alternative 1, 18 intersections would operate at LOS E or F and 9 of these intersections would be affected by the project. Under Alternative 2, 20 intersections would operate at LOS E or F and 12 of these intersections would be affected by the project. Under Alternative 3, 11 intersections would operate at LOS E or F and 4 of these intersections would be affected by the project. Under Alternative 4, 18 intersections would operate at LOS E or F and 13 of these intersections would be affected by the project. Alternative 3 would cause the fewest effects because the East Gilroy Station location would be removed from the downtown area. Alternative 2 would cause more effects than Alternatives 1 and 3 because of the larger number of roadway modifications of the at-grade track alignment. Alternative 4 would cause the most effects because of the increased gate down time at the at-grade crossings through downtown Gilroy. Relatively low demand volumes, even with added project traffic, would create conditions where most studied intersections in Morgan Hill and Gilroy would not have demand volumes that degrade conditions beyond an acceptable level.

In 2040 Plus Project conditions in the Morgan Hill and Gilroy Subsection under Alternative 1, 19 intersections would operate at LOS E or F and 8 of these intersections would be affected by the project. Under Alternative 2, 22 intersections would operate at LOS E or F and 13 of these intersections would be affected by the project. Under Alternative 3, 16 intersections would operate at LOS E or F and 2 of these intersections would be affected by the project. Under Alternative 4, 28 intersections would operate at LOS E or F and 15 of these intersections would be affected by the project. Alternative 3 would cause the fewest effects because of station location in east Gilroy would be removed from the downtown area. Alternative 2 would cause more effects than Alternatives 1 and 3 because of the larger number of roadway modifications of the at-grade track alignment. Alternative 4 would cause the most effects from the increased gate down time at the at-grade crossings through downtown Gilroy. Relatively low demand volumes, even with added project traffic, would create conditions where most studied intersections in Morgan Hill and Gilroy would not have demand volumes that degrade conditions beyond an acceptable level.

No major physical changes to the roadway network in the Pacheco Pass Subsection would occur. Therefore, effects on intersections were not studied for this subsection.

In the San Joaquin Valley Subsection, the one intersection studied at SR 165 and Henry Miller Road would be permanently converted to two intersections during project construction under all four project alternatives. In the 2029 and 2040 No Project conditions, the existing intersection would degrade to LOS F. In the 2029 and 2040 Plus Project conditions, both intersections would operate at an acceptable level.

CEQA Conclusion

The project would result in traffic delays at some intersections under all project alternatives in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections. Automobile delay is not a significant impact under CEQA.

3.2.6.3 Parking

No Project Conditions

The No Project conditions would be the same as described in Section 3.2.6.2. Growth in the Bay Area and the San Joaquin Valley would continue through the 2040 planning horizon, and the development and transportation projects listed in Appendices 3.18-A and 3.18-B would be implemented, contributing to pressure on transportation systems and parking availability. It is anticipated that parking conditions would evolve as people alter their modes and patterns of travel in response to changing land uses and transportation options under the No Project conditions.

Project Impacts

Construction Impacts

Impact TR#8: Temporary Construction-Related Effects on Parking

Temporary Effects during Construction (in areas other than San Jose Diridon Station/SAP Center)
Construction activities in urban areas associated with station, platform, and track alignment construction would require temporary removal of public parking. These activities would result in decreased parking availability and increased vehicle congestion and queuing around areas with decreased parking supply. MOWFs and construction activities in rural areas are not expected to remove or disrupt existing parking.

Any closure or removal of parking areas or roadways during construction would be temporary. Every attempt would be made to minimize their removal, shorten the length of time that these facilities are inoperable, and provide signage directing users to alternate facilities. Upon completion of construction, all parking areas would be restored.

To minimize effects on public on-street parking, the contractor will identify temporary locations to accommodate off-street parking for all construction-related vehicles (TR-IAMF#3). If adequate parking cannot be provided on the construction sites, the contractor will designate existing off-site remote parking areas in the CTP and, if the remote parking areas are distant from the construction site, will provide shuttles to carry construction workers to and from the construction area.

Temporary Effects during Construction adjacent to San Jose Diridon Station and SAP Center
Project construction would temporarily displace parking adjacent to the Diridon Station and the SAP Center, affecting San Jose Diridon Station and SAP Center users.

As shown in Table 3.2-15, Alternatives 1, 2, and 3 would affect up to 2,083 publicly available parking spaces and Alternative 4 would affect up to 397 publicly available parking spaces. With the DDV, which applies only to Alternative 4, there would be additional construction in the SAP Center parking lot north of the San Jose Diridon Station, which would temporarily displace up to 35 additional parking spaces (for a total of 116 spaces in the SAP Center parking lot and 432 spaces overall). These totals include parking within the temporary construction footprint. At any one time, some of this parking may be available for station or special event users, but this analysis conservatively assumes that temporary loss of these spaces may occur at the same time. Construction of the San Jose Diridon Station and approaches and related parking displacement could take 2 to 2.5 years.

The loss of up to 2,083 (Alternatives 1, 2, and 3), 397 (Alternative 4), or 432 (Alternative 4 with DDV) parking spaces adjacent to San Jose Diridon Station during construction would affect 15 percent (Alternatives 1, 2, 3) or 3 percent (Alternative 4, with or without the DDV) of the approximately 13,695 total publicly available parking spaces within 0.5 mile of the station and 61 percent (Alternatives 1, 2, and 3), 12 percent (Alternative 4), or 13 percent (Alternative 4 with the DDV) of 3,390 total publicly available parking spaces within 0.33 mile of the station.[16]

The amount of parking still available for use under Alternatives 1, 2, and 3 within 0.33 mile of the San Jose Diridon Station (1,307 spaces) under Alternative 4 (2,993 spaces) or under Alternative 4 with the DDV (2,958 spaces) would not meet the parking obligations specified in the Arena Management Agreement between the SAP Center and the City of San Jose (3,175 spaces). All alternatives would leave sufficient parking outside construction areas (11,612 spaces under Alternatives 1, 2, and 3; 13,298 spaces under Alternative 4; 13,263 spaces under

[16] The count of total available spaces takes into account the temporary loss of 755 spaces during BART Phase II construction.

Alternative 4 with the DDV) to meet agreement requirements relative to the 0.5-mile radius requirements (6,175 spaces).[17]

Per TR-IAMF#8, project construction contractors will identify adequate off-street parking using existing remote parking areas or vacant land to replace any temporary displacement of parking utilized for special events at the SAP Center on a 1:1 basis during construction. Contractors will arrange for shuttle vehicles between the remote parking areas and the SAP Center for any remote parking areas that are more than 0.5 mile from the SAP Center. Contractors will also work with the SAP Center to provide advance and real-time information about parking availability for special events during times in which construction displaces existing available special event parking.

While the DDV would increase the number of parking spaces temporarily displaced in the SAP Center parking lot, temporary replacement parking would be provided during construction. Displacement of parking adjacent to San Jose Diridon Station for Alternative 4 with the DDV is shown in parentheses in Table 3.2-15.

The feasibility of providing replacement off-street parking spaces during construction per TR-IAMF#8 is supported by a parking inventory (as described in VTA and FTA 2018: pages 5-104–5-107) and additional research by the Authority. The parking inventory was prepared by VTA to identify availability of parking during construction of various improvements. Available land in the area was evaluated for use for interim parking during 2018–2025. The inventory identified four possible sites that could accommodate more than 1,400 total parking spaces that met the goals and needs of interim parking for stakeholders. These sites are all within 0.5 mile from San Jose Diridon Station and at the intersections of Montgomery Street and West St. John Street, Montgomery Street and San Fernando Street, and Montgomery Street and Park Avenue (two lots).[18] Of these parking spaces, 525 are within 0.33 mile. In addition to the lots identified in the parking inventory, as described in Section 3.2.5.3, there are additional parking areas within 0.5 mile that will not be affected by construction that can also provide additional special event parking opportunities. Also, as noted in Section 3.2.5.4, an additional 4,798 public parking spaces (open 24 hours) as well as private parking areas between 0.5 mile and 1 mile of the San Jose Diridon Station would be available in downtown San Jose as well as additional parking areas beyond 1 mile of the station that could be utilized with remote parking shuttles. Based on this evidence, there are sufficient opportunities for off-street parking in the San Jose Diridon Station and SAP Center area to offset temporarily displaced parking spaces for special events. The Authority will work with the City of San Jose, the SAP Center, local development, and potentially other partners to ensure that any parking spaces temporarily displaced by the HSR project would be replaced on a 1:1 basis during construction, including potential use of parking shuttles from remote lots if adjacent lots are not available for any reason at the time of HSR project construction.

In addition, San Jose Diridon Station is an existing multimodal transportation center in San Jose's downtown urban core. It is served by several transit modes including VTA's light rail and express and local bus service, ACE, Amtrak, Capitol Corridor, and regional bus lines to Alameda and Santa Cruz Counties. This station is well connected to the City's and County's regional bicycle network and is well-served with pedestrian facilities. Consequently, many multimodal options are available for SAP Center customers and transit riders to access the station during construction.

[17] The count of total available spaces takes into account the loss of 715 spaces permanently displaced by the BART Phase II Extension.

[18] The areas at the intersections of Montgomery Street and West St. John Street, Montgomery Street and San Fernando Street, and Montgomery Street and Park Avenue (two lots) are currently available for use for interim parking based on existing conditions. However, as described in Section 3.19, Cumulative Impacts, the Google Downtown West Project (Google Project) includes proposed development at the Montgomery Street and San Fernando Street and Montgomery Street and Park Avenue locations and may also affect the Montgomery and West St. John Street location as well. Thus, the availability of these locations will depend on the timing of HSR project construction as well as Google Project construction. As discussed in Section 3.19, Cumulative Impacts, Google has committed to a net increase in available parking spaces for SAP Center events. The Authority will work with the City of San Jose, Google, the SAP Center, and potentially other partners to ensure that any parking spaces temporarily displaced by the HSR project would be replaced on a 1:1 basis during construction.

Table 3.2-15 Displacement of Parking Adjacent to San Jose Diridon Station

Location	Total Spaces	Alts 1,2,3 Temporary	Alt 4 Temporary (with DDV)	Alt 1, 2, 3 Permanent	Alt 4 Permanent (with DDV)	Notes
SAP Center Lots A, B, and C	1,422	1,422	81 (116)	247	52 (116)	Temporarily displaced spaces will be replaced by off-site remote parking and shuttles for special events (TR-IAMF#8). Permanent displacement for Alternatives 1, 2, and 3 includes all existing spaces in footprint. Since the alignment would be on aerial structure over the parking lot, the actual displacement would be less than shown. Permanently displaced spaces would be replaced with either parking north of Julian at the corner of Julian/Montgomery (Alternatives 1, 2, and 3) or a new parking structure on the northern part of the existing lot (Alternative 4). The replacement parking areas are as shown on design drawings in Volume 3, Preliminary Engineering for Project Design Record (see Drawing AR-C0201 in Volume 3, Book 4C, Sheet 58 of 148).
SAP Center Lot D	228	0	0 (0)	0	0 (0)	
Cahill Lots 1, 2 (northeast of station)	180	0	0 (0)	0	0 (0)	
Cahill Lot 3 (northeast of station)	162	162	0 (0)	0	0 (0)	Temporarily displaced spaces will be replaced by off-site remote parking and shuttles for special events (TR-IAMF#8).
Cahill Lot 4 (north of station)	148	148	148 (148)	148	0 (0)	Temporarily displaced spaces will be replaced by off-site remote parking and shuttles for special events (TR-IAMF#8). Permanently displaced spaces would be replaced by new parking structures northwest and south of the station (Alternatives 1, 2, and 3) or parking structures northwest and north of the station (Alternative 4).
Cahill Center Lot (east of station)	90	90	90 (90)	0	90 (90)	Temporarily displaced spaces will be replaced by off-site remote parking and shuttles for special events (TR-IAMF#8). Permanently displaced spaces would be replaced by new parking structures northwest and north of the station (Alternative 4).

Location	Total Spaces	Alts 1,2,3 Temporary	Alt 4 Temporary (with DDV)	Alt 1, 2, 3 Permanent	Alt 4 Permanent (with DDV)	Notes
Cahill Lots (south of Station)	78	78	78 (78)	78	71 (71)	Temporarily displaced spaces will be replaced by off-site remote parking and shuttles for special events (TR-IAMF#8). Permanently displaced spaces would be replaced by new parking structures northwest and south of the station (Alternatives 1, 2, and 3) or parking structures northwest and north of the station (Alternative 4).
Stephen's Meat Loaf	135	68	0 (0)	0	0 (0)	Temporarily displaced spaces will be replaced by off-site remote parking and shuttles for special events (TR-IAMF#8).
Navlets	65	65	0 (0)	0	0 (0)	Temporarily displaced spaces will be replaced by off-site remote parking and shuttles for special events (TR-IAMF#8).
Palermo and adjacent	70	0	0 (0)	0	0 (0)	
On-Street Parking	95	50	0 (0)	0	0 (0)	Temporarily displaced spaces will be replaced by off-site remote parking and shuttles for special events (TR-IAMF#8).
TOTAL	**2,578**	**2,083**	**397 (432)**	**473**	**213 (277)**	

Note: Displacement of parking adjacent to San Jose Diridon Station for Alternative 4 with the DDV is shown in parentheses.
DDV = Diridon design variant.

Operations Impacts

Impact TR#9 Permanent Effects Related to Parking

Permanent Effects during Operations (Downtown Gilroy Station/East Gilroy Station)

The FRA and the Authority have a strategy for long-term coordination with local transit agencies and cities to develop transit connectivity plans for HSR station areas and for connectivity to neighboring communities where high HSR ridership is projected. This strategy, as outlined in LU-IAMF#2, is expected to minimize the overall demand for parking at stations by facilitating alternative methods of station access (refer to *HST Station Area Development: General Principles and Guidelines* [Authority 2011]). LU-IAMF#2 will improve connections to HSR stations, reducing the demand for HSR parking. Therefore, parking included in the project footprint, in combination with other access modes, would be sufficient to meet projected 2040 demand.

As shown in Table 3.2-3, the total number of trips related to parked vehicles in 2040 would be 2,100 at the Downtown Gilroy Station (Alternatives 1, 2, and 4) and 2,700 at the East Gilroy Station (Alternative 3). Each parking space is associated with 1.66 trips (as some vehicles are parked for multiple days). As shown in Table 3.2-4, the average number of passengers per parked car for the Gilroy stations is 1.31. Consequently, the daily access/egress trips associated with the Downtown Gilroy Station would create an additional demand for 966 parking spaces (beyond current existing demand); daily trips associated with the East Gilroy Station would create a demand for 1,242 parking spaces. The DDV and the TDV would not change HSR ridership compared to the alternatives without the DDV and TDV and thus would not change station traffic or transit operations or parking demand.

At the Downtown Gilroy Station (Alternatives 1, 2, and 4), HSR would provide an additional 970 spaces, exceeding the projected 2040 additional demand for 966 parking spaces. The total resultant parking spaces would be 1,710 spaces including the new parking spaces. All displaced parking at the Downtown Gilroy Station would be replaced at a 1:1 ratio.

At the East Gilroy Station (Alternative 3), HSR would provide 1,520 new parking spaces, exceeding the projected 2040 demand of 1,242 spaces; no compensatory parking would be needed, because this would be a new station and there would be no displacement of existing parking spaces.

Because the parking provided at the Gilroy stations would exceed the additional parking demand created by HSR riders, there would be no need for construction of additional off-site parking facilities and there would be no secondary environmental effects from construction of such facilities and no secondary effects (e.g., traffic, VMT, air quality, noise, safety, land use, socioeconomic effects) caused by insufficient parking supply.

Permanent Effects during Operations (San Jose Diridon Station and SAP Center)

Permanent Loss of Existing Parking

As shown in Table 3.2-15, Alternatives 1, 2, and 3 would permanently displace up to 247 and Alternative 4 would permanently displace up to 52 publicly available parking spaces in the SAP Center Lots A, B, and C. With the DDV, due to the track shift north of San Jose Diridon Station, Alternative 4 would permanently displace up to 116 publicly available parking spaces in the SAP Center Lots A, B, and C. For Alternatives 1, 2, and 3, the total includes all parking spaces within the viaduct footprint. However, there would be an opportunity for some parking beneath the viaduct between the viaduct columns; consequently, the actual amount of displacement would be less than 247. Replacement parking (on a 1:1 basis for all alternatives) would be provided in a new parking structure on the north side of SAP Center Lots A, B, and C. Thus, the DDV would not result in any net change in available parking for the SAP Center relative to Alternative 4 without the DDV, nor would it result in any loss in available parking spaces.

As shown in Table 3.2-15, excluding the SAP Center Lots A, B, and C, all alternatives would permanently displace between 161 and 226 publicly available parking spaces at the San Jose Diridon Station. Replacement parking (on a 1:1 basis) would be provided in new parking facilities on the northwest side of the intersection of Stockton Avenue and The Alameda (all alternatives),

north of the station (Alternative 4), and near the intersection of Cahill Street and Park Street (Alternatives 1, 2, and 3).

There would be no permanent loss of parking at the SAP Center or at the San Jose Diridon Station caused by the project compared to No Project conditions.

Increased Parking Demand

As shown in Table 3.2-3, the total number of trips related to parked vehicles in 2040 would be 2,340 at the San Jose Diridon Station. Each parking space is associated with 1.66 trips (as some vehicles are parked for multiple days). As shown in Table 3.2-4, the average number of passengers per parked car for the San Jose Diridon Station is 1.33. Consequently, the daily access/egress trips associated with the San Jose Diridon Station would create an additional demand for 1,060 parking spaces (beyond current existing demand).

The increased HSR demand of 1,060 parking spaces would affect 31 percent of the approximately 3,430 publicly available parking spaces within 0.33 mile of the San Jose Diridon Station and 8 percent of the approximately 13,735 parking spaces within 0.5 mile.[19] As noted in Section 3.2.5.3, San Jose Diridon Station and SAP Center Parking, there are 4,798 public parking spaces between 0.5 and 1 mile from the San Jose Diridon Station as well as private parking lots, and additional parking opportunities more than 1 mile from the station, including at the San Jose International Airport.

The Authority would rely on commercially available parking to meet HSR parking demand, provided and priced in accordance to local conditions. Local jurisdictions, such as the City of San Jose, establish policies for on-street parking, public lots, and for new development parking. As shown by over a decade of research by MTC on best practice parking policy and case studies summarized in the Value Pricing Pilot Parking Project, sharing and pricing parking extend the use and supply of parking resources and influence parking market demand and parking occupancy (MTC n.d.). The federally funded San Francisco Municipal Transportation Agency (SFMTA) evaluation report of the SFpark Pilot Project found that parking pricing and management in a local environment where parking demand is greater than the supply of parking can increase the availability of parking, ease finding a parking space, reduce average parking rates, and reduce GHG and VMT (SFMTA 2014). SFMTA has special event parking regulations and pricing for events at the Oracle Park and the Chase Center to make sure parking spots are available for events and to reduce traffic congestion by discouraging circling for free or cheaper parking near the ballpark and arena[20] (SFMTA n.d.). The City of San Jose has an agreement about maintaining a certain number of available parking spaces for SAP Center event use and has applied parking requirements for recent development, such as the Google Project. This research and real-world experience support the Authority's assumption that local parking can be priced and managed to meet the Authority's parking needs and SAP Center event parking needs (Authority 2021b).

The SAP Center (capacity of approximately 17,500) is similar to the Oakland Coliseum/Oracle Arena (capacity of approximately 19,600), which is adjacent to the Coliseum BART Station (although the walk to the SAP Center is shorter, with the San Jose Diridon Station being directly across the street). There are approximately 170 events at the SAP Center each year and 200 events at the Oakland Coliseum/Oracle Arena. In 2016, of tickets sold for Oakland Coliseum/Oracle Arena events, 20 to 30 percent of patrons accessed the event from the Coliseum BART station.

The final supplemental EIS/EIR for the BART Phase II Extension (VTA and FTA 2018: pages 5-104–5-107) proposed a more conservative estimate of 10 percent of patrons (1,750) accessing SAP Center events by BART. Assuming a vehicle occupancy of 2.5 persons per vehicle for SAP

[19] These calculations take into account the permanent loss of 715 spaces due to the BART extension.

[20] For example, SFMTA parking meters on blocks within walking distance to the two venues operate from 9 a.m. to 10 p.m. Monday to Saturday and from 12 p.m. to 6 p.m. on special event Sundays and special event hours with meters priced at $8/hour.

patrons, a 10 percent BART mode share would reduce parking demand by 700 spaces, which would nearly offset the loss of 715 spaces caused by the BART Phase II Extension. In addition to new BART service, the PCEP would also increase peak hour capacity of the San Jose Diridon Station by 20 percent over existing conditions, increasing transit rider access to the SAP Center and resulting in additional offset of parking demand. With the SAP Center served in the future by BART, electrified Caltrain, VTA light rail, rapid bus, and intercity bus service, a 10 percent transit mode share is considered highly conservative, and a 20 to 30 percent transit mode share can be anticipated.

A 20 to 30 percent mode shift would reduce parking demand by 1,400 to 2,100 cars per event (assuming 2.5 persons per vehicle)[21]. Assuming a 20 percent increase in transit share, the transit increase would offset demand for 1,400 parking spaces, leaving a net increased demand of 375 parking spaces (increase demand due to permanent loss of 715 parking spaces due to BART and 1,060 spaces of demand due to HSR riders minus the offset of 1,400 parking spaces). This net demand of 375 parking spaces would affect 11 percent of the approximately 3,430 remaining publicly available parking spaces within 0.33 mile of Diridon Station and 3 percent of the approximately 13,735 parking spaces within 0.5 mile.[22] As noted in Section 3.2.5.3, San Jose Diridon Station and SAP Center Parking, there are an additional 4,798 public parking spaces between 0.5 and 1 mile from the San Jose Diridon Station, as well as private parking lots and additional parking opportunities more than 1 mile from the station, including at the San Jose International Airport. Assuming a 30 percent increase in transit share, the transit increase would offset demand for 2,100 parking spaces, which would more than offset the loss of 715 spaces due to BART and the 1,060 parking space demand for HSR riders. In any case, there would be adequate remaining parking in the general proximity of the SAP Center for SAP Center patrons.

The decision to not provide park-and-ride facilities for HSR service at San Jose Diridon Station is consistent with the *Envision: San Jose 2040 General Plan*, Commercial Downtown Land Use Plan Policies and Transportation Policies (adopted November 2011). The Commercial Downtown Land Use Policies state that “all development within this designation should enhance the ‘complete community’ in downtown, support pedestrian and bicycle circulation, and increase transit ridership. The Downtown Urban Design Policies speak to the urban, pedestrian-oriented nature of this area. As such, uses that serve the automobile should be carefully controlled in accordance with the Downtown Land Use Policies.”

San Jose’s Transportation Goals, Policies, and Actions aim to establish circulation policies that increase bicycle, pedestrian, and transit travel, while reducing motor vehicle trips, to increase the City’s share of travel by alternative transportation modes. The policy of Goal TR-1.3, Balanced Transportation System, is to “increase substantially the proportion of commute travel using modes other than the single-occupant vehicle. The 2040 commute mode split target for San Jose residents and workers are presented in Table TR-1”, which displays the goal for Drive alone as no more than 40 percent and Transit as at least 20 percent (City of San Jose 2018). San Jose Diridon Station is intended to be in alignment with the City’s mode shift goal.

The Authority initiated the San Jose Diridon Station Intermodal Working Group to coordinate the planning, design, and delivery of concurrent and interrelated transportation infrastructure projects: HSR, BART Phase II, and PCEP. The Authority has funded two grants to prepare the station area for HSR operations, including the development of strategies to address the supply, demand, and management of parking in the station area. The grant to the City of San Jose funded an evaluation of short-term and long-term parking needs during construction and operation of both HSR and BART Phase II, and is supporting several site-specific parking studies in the San Jose Diridon Station area to develop a Parking Program for the Diridon Station Area Plan. The grant to VTA is to prepare a San Jose Diridon Station Facilities Master Plan to address both station and

[21] The assumption of 2.5 passengers/vehicle for SAP patrons is based on a factor of 2.41 passengers/vehicle from a study of passengers/vehicle for the Oakland Coliseum (Authority 2019b) that was rounded up to 2.5. No data were located for passengers/vehicle for the SAP Center.

[22] These calculations take into account the permanent loss of 715 spaces due to the BART extension.

station area facilities, criteria for replacing any parking displaced for new station facilities, and a program to manage the evolution of parking demand and supply over time to reflect changes in ridership and park-and-ride mode share. The City of San Jose is also considering parking during an ongoing update to the adopted Diridon Station Area Plan and the separate planning related to the Diridon Station Integrated Station Concept Plan. The City of San Jose and VTA studies will inform a multimodal access plan, which will be developed prior to design and construction of the station. This plan will be developed in coordination with local agencies and will include a parking strategy that will inform the final location, amount, and phasing of parking.

The San Jose Diridon Station is well served by existing multimodal options that are planned to improve with the Caltrain electrification and BART extension projects, which would increase transit options for SAP customers and transit riders to access the station. HSR service would only add to the many multimodal options available to travelers with the San Jose Diridon Station as their intended destination. In view of these characteristics, the project's increased parking demand is not expected to result in insufficient parking for either the San Jose Diridon Station or the SAP Center or to result in the construction of additional remote parking facilities.

Indirect Environmental Effects Related to the Diridon Station and SAP Center

As previously described, the project would replace all permanently displaced parking with nearby replacement parking facilities on a 1:1 basis. The project's demand for additional parking can be met by existing parking facilities, especially in light of the increased transit service planned for San Jose Diridon Station. The SAP Center's parking demand can similarly be met through the combination of existing parking facilities, the replacement parking facilities provided by the project, and the offsetting effect on parking demand caused by planned increases in transit services. Thus, no new additional remote parking facilities would be required to meet these demands.

While parking demands can be met, because of the BART Phase II Extension permanent displacement of 715 spaces near the San Jose Diridon Station and the potential for some HSR riders to use spaces near the station, it is possible that some station users and SAP Center patrons would need to use more distant parking spaces. The extensive information on available parking provided by Caltrain, City of San Jose (Park San Jose), the SAP Center, and private vendors and the increasing use of web-based and mobile applications (including real-time applications) means that most station users and SAP Center patrons would be able to readily locate parking without extensive circling. Furthermore, parking information would be advanced through integrated planning by the City of San Jose, VTA, the Authority, and other partners as development in the station area advances, such that information available by the time HSR is operational would be superior to that currently available. While there may some minor increases in local travel due to the use of slightly more remote lots, this local travel is expected to be more than offset by the overall reduction in parking demand resulting from increased transit service.

Potential secondary environmental effects of the use of slightly more remote parking facilities are reviewed below:

- **Transportation**—Minor increases in circling could contribute to traffic congestion on streets near the San Jose Diridon Station and SAP Center as well as minor increases in VMT. However, as previously discussed, the net demand for parking is expected to decrease due to transit service expansion (including planned Caltrain service increases as well as the additions of new BART and HSR service) which would more than offset any effects caused by the use of more remote parking facilities. In addition, the HSR project would substantially reduce overall VMT, also reducing traffic on major roadways accessing downtown San Jose.
- **Air Quality**—As previously discussed, overall parking demand is expected to decrease, even taking into account the loss of parking caused by the BART Phase II project and the increased parking demand of HSR, such that vehicle emissions caused by localized use of more remote parking lots would be more than offset. Furthermore, as described in Section 3.3, Air Quality and Greenhouse Gases, local intersections most affected by project-related traffic do not have sufficient traffic volumes to trigger local carbon monoxide hot spots. Finally, the project overall would substantially reduce regional criteria pollutants.

- **Noise**—As previously discussed, with an overall net reduction in parking demand resulting from increased transit service, the increased use of more remote parking lots is not expected to substantially change traffic volumes or traffic noise. Furthermore, as described in Section 3.4, Noise and Vibration, project-related traffic noise near stations would not result in an increase in noise levels above the project-related train noise.
- **Safety**—As described in this section and in Section 3.11, Safety and Security, the area around the San Jose Diridon Station and the SAP Center is well served by existing roadway, transit, bicycle, and pedestrian facilities. Existing pedestrian facilities connect remote lots to the station and the SAP Center. Increased use of remote parking lots would not increase safety risks for people accessing the station or the SAP Center.
- **Land Use**—Parking at the San Jose Diridon Station would be accommodated in existing lots, with the additional construction of two small new lots. The construction of the proposed new parking lots near the San Jose Diridon Station to accommodate demand would not create land use conflicts because they would be consistent with applicable plans, would be compatible with adjacent land uses under existing zoning, and would not ultimately change existing conditions for adjacent land uses outside the project area or change land use patterns. Since the project would not result in the construction of new remote parking lots (other than those included in the project description), the project would not displace any additional land uses or disrupt existing land use patterns through construction of any such additional remote parking lots.

Socioeconomic Effects

As previously discussed, demand for all modes of access to the San Jose Diridon Station and the SAP Center, including parking, can be accommodated through existing parking facilities, project parking facilities, and the offsetting reduction of parking demand through the increase in transit service. Consequently, the SAP Center is not expected to experience a reduction in patronage for special events. The recent experience of other downtown sports and event-serving arenas in transit-accessible locations further supports a conclusion that the economic vitality of the SAP Center would not be adversely affected and may actually receive a benefit (Authority 2019b).

Over the last 20 years, 18 new arenas have been built for National Basketball Association and National Hockey League franchise teams in the U.S. Fifteen arenas are in downtown, transit-accessible locations adjacent to central business districts to maximize access and competitiveness to attract regional market demand for sports and entertainment events. A downtown arena location adjacent to a central business district offers the opportunity to benefit from regional transit and highway access created for commuters, the sharing of off-peak employment parking, and direct walking access for the downtown employment base to events.

Several new arenas, such as the Golden 1 Center for the Sacramento Kings, the Chase Center for the Golden State Warriors, and the Little Caesar's Arena for the Detroit Pistons and the Red Wings are part of an American trend where cities—not the suburbs—have returned as the primary generators of the nation's economic growth according to the Federal Reserve. In the effort to reduce GHG emissions and fight climate change, some U.S. cities are transitioning away from auto-dependence by investing in transit and TOD. Arenas are contributing to and benefiting from this urban downtown renaissance, with billion-dollar public and private investments in transit and mixed-use TOD composed of office, retail, and housing. This resurgence of downtowns is attracting millennials as well as baby boomers to the vibrancy of urban living without needing a car.

Research on event day parking information for the 18 National Basketball Association and National Hockey League arenas built over the last 20 years demonstrates that downtown arenas are benefiting from regional transit service and the use of shared parking to meet event travel demand. Parking is priced based on proximity and convenience to the venue, with highest cost premium convenience parking adjacent to the arena and lower cost options located a 5- to 10-minute walk (or more) from the arena. Transit service is adjacent to or within a short walk of most of these facilities and, in some cases, additional event day transit service is offered. Websites

such as StadiumParkingGuide.com provide maps with the location, availability, and pricing of event parking so attendees can make choices on how to most conveniently and affordably access the event in advance or at the time of the event.

All these venues, including the SAP Center, ranked in the top 100 venues worldwide in ticket sales in 2018 by Pollstar Magazine, indicating that a transit-accessible downtown location supports economic success.

CEQA Conclusion

The impact under CEQA would be less than significant for all four project alternatives because secondary environmental effects on transportation, air quality, noise, safety, or land use related to parking would either not occur or would be less than significant using the thresholds for evaluation of these subjects. The temporary displacement of existing parking from construction activities will be managed through project features, including temporary replacement of any displaced parking for special events at the SAP Center. Permanently displaced parking spaces at the San Jose Diridon Station and SAP Center area would be replaced on a 1:1 basis to preclude permanent loss of parking spaces for station users or SAP Center patrons. The increase in parking demand caused by HSR riders at the San Jose Diridon Station would be accommodated through existing parking facilities, project parking facilities, and the offsetting effect of increased transit service to the San Jose Diridon Station such that no non-project remote parking facilities would need to be built. The project would not result in significant secondary environmental effects (on transportation, air quality, noise, safety, or land use) related to parking demands or non-project remote parking facilities, with or without the DDV. Therefore, CEQA does not require mitigation.

3.2.6.4 Transit

Construction and operations of the project alternatives would result in temporary and permanent impacts on bus transit operations and temporary impacts on passenger rail operations. The construction of the design variants would not affect any different transportation facilities than the alternatives without the DDV and TDV. Project construction would disrupt roadway and rail transit services. Project operations would increase the number of station passengers and would change the demand for transit services at the shared San Jose Diridon Station and the downtown Gilroy station. Project operations would also include use of Caltrain rail lines between I-880 and Scott Boulevard under Alternative 1.

No Project Conditions

The No Project conditions are the same as those described in Section 3.2.6.2, Roadways, Freeways, and Intersections (Vehicle Circulation). Population in Santa Clara, San Benito, and Merced Counties is projected to increase through 2029 and 2040. Development projects to accommodate projected population growth, including residential, commercial, industrial, recreational, and transportation projects, would continue under the No Project conditions and would result in increased demands on transit services and the resulting need to continue expanding transit services.

The No Project conditions include the implementation of transit projects identified and funded in *Plan Bay Area 2040* (ABAG and MTC 2017) and other plans identified in Section 3.2.2.3, Regional and Local. These projects include new or enhanced rail and bus facilities to expand transit capacity and performance in the RSA. The 2029 and 2040 No Project transit improvements, which are shown in Table 3.2-16, would primarily affect San Jose Diridon Station.

Table 3.2-16 2029 and 2040 No Project Transit Improvements

Project Name	Description
Peninsula Corridor Electrification Project	The PCEP will include the installation of electrification infrastructure including traction power facilities, poles and OCS, and EMUs along over 50 miles of the Caltrain corridor between San Francisco and San Jose. Advanced signal systems will be installed to increase operational safety and establish a communication-based overlay signal system, known as positive train control, and the existing diesel locomotive-hauled fleet for service from Tamien north to San Francisco will be replaced with EMUs to facilitate the Blended Caltrain and HSR System. The PCEP does not include electrification of service south of the Tamien Station and does not include any changes in diesel commuter rail service between the Gilroy station and the Tamien Station. PCEP is planned for completion by 2022.
BART to Silicon Valley	The BART to Silicon Valley project would implement a 16-mile extension from Warm Springs Station in Fremont to Santa Clara in two phases. Phase I, the Berryessa Extension Project, would connect Warm Springs to new stations in Milpitas and Berryessa, while Phase II would connect Berryessa Station to new stations in Alum Rock, downtown San Jose, San Jose Diridon Station, and Santa Clara. This project is planned for completion by 2025.
VTA Bus Rapid Transit Projects	The Santa Clara/Alum Rock BRT project would enhance service for 7.2 miles at 11 planned stations, from the Eastridge Transit Center to the Arena Station in downtown San Jose using Capitol Expressway, Alum Rock Avenue, and Santa Clara Street. The project would include enhanced bus stops along Santa Clara Street near San Jose Diridon Station and dedicated bus lanes along a portion of Alum Rock Avenue. This project was substantially completed in 2017. The Stevens Creek BRT project would upgrade the current VTA Limited 323 bus route that travels along Stevens Creek Boulevard and San Carlos Street between De Anza College in Cupertino and the Downtown San Jose Transit Mall in San Jose. BRT service would also extend east to the Eastridge Transit Center along the Santa Clara–Alum Rock corridor. A stop is planned at the intersection of Bird Avenue and San Carlos Street approximately 2,000 feet from San Jose Diridon Station. The new service (Rapid 523) started at the end of 2019.
VTA Light Rail Extensions	The Capitol Expressway light rail extension would extend light rail service approximately 2.5 miles from Alum Rock Station to the Eastridge Transit Center, adding two new stations at Storey Road and Eastridge. This project is planned for completion by 2025. The Vasona light rail extension Phase II would extend light rail service approximately 1.6 miles from Winchester Station to SR 85 in Los Gatos. The schedule for completion has not been established.
TAMC Monterey County Rail Extension	The Monterey County Rail Extension Project would extend passenger rail service from Santa Clara County south to Salinas. The initial phase (called the "Kick Start Project) includes Salinas train station circulation improvements, train layover facility, and Gilroy track improvements and two daily round trips. Future phases will expand up to six round trips as demand warrants. Construction is starting in 2019 for the first phase. The schedule for subsequent phases has not been established.

Sources: Caltrain 2017; VTA 2017a,; ABAG and MTC 2017
BART = Bay Area Rapid Transit System
BRT = bus rapid transit
EMU = electric multiple unit train
HSR = high-speed rail
OCS = overhead contact system
PCEP = Peninsula Corridor Electrification Project
SR = State Route
TAMC = Transportation Agency for Monterey County
VTA = Santa Clara Valley Transportation Authority

After implementation of the PCEP project, rail service would increase along the project extent. Twenty-two trains would be added between Santa Clara Station and San Jose Diridon Station, totaling 138 passenger trains per day. South of San Jose Diridon Station, future rail service would remain less concentrated: between San Jose Diridon Station and Tamien Station, the corridor would serve 46 passenger trains per day, while south of Tamien Station the corridor would continue to serve six passenger trains per day. Table 3.2-17 describes assumed 2029 passenger and freight rail operations. Table 3.2-18 describes assumed 2040 passenger and freight rail operations.

Table 3.2-17 Assumed 2029 Passenger and Freight Train Operations

System	Period	Total Daily Trains (Both Directions) per Segment				
		Lawrence–Santa Clara	Santa Clara–Diridon	Diridon–Tamien	Tamien–Gilroy	South of Gilroy
Caltrain[4]	Daytime[1]	100	100	49	4[5]	0
	Nighttime[2]	14	14	5	2-4[5]	0
	Peak hour[3]	12	12	4	2-4[5]	0
	Total	**114**	**114**	**54**	**6-8[5]**	**0**
ACE / Amtrak Capitol Corridor	Daytime[1]	0	40	40	0	0
	Nighttime[2]	0	2	2	0	0
	Peak hour[3]	0	14	14	0	0
	Total	**0**	**42**	**42**	**0**	**0**
Coast Starlight	Daytime[1]	0	2	2	2	2
	Nighttime[2]	0	0	0	0	0
	Peak hour[3]	0	2	2	2	2
	Total	**0**	**2**	**2**	**2**	**2**
Freight	Daytime[1]	0	0	0	0	0
	Nighttime[2]	4	9	5	5	5
	Peak hour[3]	2	2	2	2	2
	Total	**4**	**9**	**5**	**5**	**5**
Coast Daylight	Daytime[1]	0	0	2	2	2
	Nighttime[2]	0	0	0	0	0
	Peak hour[3]	0	0	1	1	1
	Total	**0**	**0**	**2**	**2**	**2**
TAMC Salinas Rail Extension	Daytime[1]	0	0	8	8	8
	Nighttime[2]	0	0	0	0	0
	Peak hour[3]	0	0	1	1	1
	Total	**0**	**0**	**8**	**8**	**8**

System	Period	Total Daily Trains (Both Directions) per Segment				
		Lawrence–Santa Clara	Santa Clara–Diridon	Diridon–Tamien	Tamien–Gilroy	South of Gilroy
BART SVSX	Daytime[1]	0	265	0	0	0
	Nighttime[2]	0	50	0	0	0
	Peak hour[3]	0	20	0	0	0
	Total	**0**	**315**	**0**	**0**	**0**
Total Trains		**118**	**482**	**113**	**23-25**	**17**

ACE = Altamont Corridor Express
BART = Bay Area Rapid Transit
EMU = electric multiple unit train
SVSX = Silicon Valley Santa Clara Extension
TAMC = Transportation Agency for Monterey County
[1] Daytime is defined as between 7:00 a.m. and 10:00 p.m.
[2] Nighttime is defined as between 10:00 p.m. and 7:00 a.m.
[3] Approximate
[4] In 2029 under Alternatives 1, 2, and 3, Caltrain operations north of Tamien would be a mix of 75 percent EMU trains and 25 percent diesel locomotive-hauled trains, and Caltrain operations south of Tamien would be 100 percent diesel locomotive-hauled trains. Under Alternative 4, Caltrain operations would be 100 percent EMU trains.
[5] Under Alternatives 1, 2, and 3, there would be six Caltrain operations between Tamien and Gilroy. Under Alternative 4, there would be eight Caltrain operations between Tamien and Gilroy.

Table 3.2-18 Assumed 2040 Passenger and Freight Train Operations

System	Period	Total Daily Trains (Both Directions) per Segment				
		Lawrence–Santa Clara	Santa Clara–Diridon	Diridon–Tamien	Tamien–Gilroy	South of Gilroy
Caltrain[4]	Daytime[1]	100	100	47	4[5]	0
	Nighttime[2]	14	14	5	2-4[5]	0
	Peak hour[3]	12	12	4	2-4[5]	0
	Total	**114**	**114**	**52**	**6-8[5]**	**0**
ACE / Amtrak Capitol Corridor	Daytime[1]	0	48	20	0	0
	Nighttime[2]	0	2	0	0	0
	Peak hour[3]	0	14	6	0	0
	Total	**0**	**50**	**20**	**0**	**0**
Coast Starlight	Daytime[1]	0	2	2	2	2
	Nighttime[2]	0	0	0	0	0
	Peak hour[3]	0	2	2	2	2
	Total	**0**	**2**	**2**	**2**	**2**
Freight	Daytime[1]	0	0	0	0	0
	Nighttime[2]	7	12	7	7	7
	Peak hour[3]	2	2	2	2	2
	Total	**7**	**12**	**7**	**7**	**7**

System	Period	Total Daily Trains (Both Directions) per Segment				
		Lawrence–Santa Clara	Santa Clara–Diridon	Diridon–Tamien	Tamien–Gilroy	South of Gilroy
Coast Daylight	Daytime[1]	0	0	4	4	4
	Nighttime[2]	0	0	0	0	0
	Peak hour[3]	0	0	1	1	1
	Total	**0**	**0**	**4**	**4**	**4**
TAMC Salinas Rail Extension	Daytime[1]	0	0	12	12	12
	Nighttime[2]	0	0	0	0	0
	Peak hour[3]	0	0	1	1	1
	Total	**0**	**0**	**12**	**12**	**12**
BART SVSX	Daytime[1]	0	265	0	0	0
	Nighttime[2]	0	50	0	0	0
	Peak hour[3]	0	20	0	0	0
	Total	**0**	**315**	**0**	**0**	**0**
Total Trains		**121**	**493**	**97**	**31-33**	**25**

ACE = Altamont Corridor Express
BART = Bay Area Rapid Transit
EMU = electric multiple unit train
SVSX = Silicon Valley Santa Clara Extension
TAMC = Transportation Agency for Monterey County
[1] Daytime is defined as between 7:00 a.m. and 10:00 p.m.
[2] Nighttime is defined as between 10:00 p.m. and 7:00 a.m.
[3] Approximate
[4] In 2040, Caltrain operations north of Tamien would be 100 percent EMU trains. Caltrain operations south of Tamien would be 100 percent diesel locomotive-hauled trains.
[5] Under Alternatives 1, 2, and 3, there would be six Caltrain operations between Tamien and Gilroy. Under Alternative 4, there would be eight Caltrain operations between Tamien and Gilroy.

Project Impacts

Construction Impacts

Impact TR#10: Temporary Impacts on Bus Transit

Project-related construction staging and traffic would interfere with bus transit along roadways and at the existing San Jose Diridon and Downtown Gilroy Stations. The construction of the HSR stations, platforms, and track alignment would require TCEs. The TCEs would require the temporary closure of parking areas, bus stops, transit stations, or roadway travel lanes. Any closure of bus stops, transit stations, roadways, or transit lines during construction would be temporary.

The impact of roadway, bus stop, or bus line routing changes would depend on the location and duration of these changes. Impacts on bus facilities would include the following:

- Temporary closure and relocation of bus stops.
- Temporary rerouting of bus lines because of temporary roadway closures.
- Temporary closure of parking to accommodate relocated bus facilities.
- Temporary closure and relocation of sidewalks, crosswalks, and curb ramps used to access bus stops.

In accordance with the construction management plan (CMP) and CTP, the contractor would attempt to provide temporary bus stops, parking areas, and access with the same features and

amenities that the relocated facility had, such as lighting, seating, shelters, and signage. However, some riders would experience inconvenience and changes in access. Rerouting and detours of bus lines would increase travel time for passengers. Increased travel times and modified access would temporarily reduce bus ridership for the duration of construction.

Alternatives 1, 2, and 3 would have more effects than Alternative 4 in the Monterey Corridor Subsection and overall due to more substantial roadway changes and closures needed during construction. The lane narrowing on Monterey Road under Alternatives 1, 2, and 3 would result in more temporary bus stops than Alternative 4, which would not require lane narrowing in the Monterey Corridor. A review of all the roadway changes with Alternative 4 indicated that none of them would require full road closures where there is existing bus services, and thus with Alternative 4 disruption of bus transit services would be limited to construction at/near the San Jose Diridon and Gilroy Stations.

The contractor would attempt to minimize disruption or shorten the length of time that transit facilities are inoperable and would provide signage to alternate facilities. Upon completion of construction, the contractor would restore parking areas, bus stops, and roadway travel lanes. To minimize conflicts with transit during construction, the contractor will prepare a specific CMP (TR-IAMF#11) to maintain transit access and safe and adequate access for these users during construction. In addition, the CTP will include methods to minimize construction traffic. A CTP traffic control plan will include provisions to maintain transit flows and access, minimize operations hazards through alternative access and bus route detour provisions, minimize transit schedule disruptions, identify temporary bus stops away from construction locations, and separate transit users from construction locations. Implementation of standard construction practices would establish construction truck routes, restrictions on construction hours, and construction vehicle parking.

CEQA Conclusion

The impact under CEQA would be significant for all four project alternatives because construction vehicles or temporary roadway closures would interfere with bus routes and bus stops, which, in turn, would materially decrease the performance of certain bus routes. With Alternative 4, these effects would occur related to construction at the San Jose Diridon and Gilroy Stations only. Changes to bus routes and bus stops would be managed through development and implementation of a CMP and CTP, but material decreases in certain bus routes would still occur. The CMP and CTP would include methods to maintain bus transit operations and access including traffic control methods, safe alternate access locations, restrictions on construction hours, designated truck routes, and construction vehicle parking to minimize operations hazards and interference with the local roadway network. Decreases to the performance of bus transit facilities would be minimized through implementation of plans to control and manage construction vehicle traffic; however, material decreases in the performance of certain bus routes would still occur. Mitigation measures to address this impact are identified in Section 3.2.9, CEQA Significance Conclusions. Section 3.2.7, Mitigation Measures, describes these measures in detail.

Impact TR#11: Temporary Impacts on Passenger Rail Operations

Project-related construction, staging, and traffic would contribute to temporary interference with passenger rail transit. The construction of the HSR stations, platforms, and track alignment would require TCEs. The TCE may require the temporary closure of transit stations, passenger rail platforms, and passenger rail track for other operators where the systems interface. Any closure of passenger rail stations, platforms, and track during construction would be temporary (on the scale of hours or days except as related to the Caltrain College Park Station for certain alternatives). Where passenger rail stations are closed (other than College Park), temporary stations would be established to avoid cessation of service at that station. The key areas of disruption to passenger rail systems are summarized as follows, including estimated locations (from north to south) and estimated durations of disruption.

Alternative 3 would have the least disruption to passenger rail operations during construction, followed by Alternative 1 and Alternative 4. Alternative 2 would have the most disruption to passenger rail operations during construction.

Alternative 1 would include the following locations of potential disruption to passenger rail operations:

- **Entire route**—Alternative 1 would include some utility relocation work at discrete locations, but this is not expected to result in delay or closure of passenger rail service.
- **San Jose Diridon Station Approach Subsection**—Alternative 1 would require relocation of three existing tracks, MT-1, MT-2 and MT-3 from north of I-880 to Julian Street. During connection of the existing tracks to the new tracks, the existing track may shut down for 1 to 2 days (on weekends if feasible), which would affect Caltrain, ACE, Amtrak, and Capitol Corridor service. Alternative 1 would also require a rebuild of the Caltrain College Park Station and the tracks leading into the station; this station would be shut down for 1 to 2 years. At San Jose Diridon Station, construction of the aerial HSR station would require closure of one platform (two tracks) at a time; the station would continue to operate for Caltrain, ACE, and Capitol Corridor, but during peak times there would be more congestion with the closure of two tracks and one platform. Alternative 1 would cross over the Caltrain Corridor just east of the SR 87 crossing. Construction of the crossovers has the potential for several-day closures (on weekends if feasible). South of West Alma Avenue to CP Lick, Alternative 1 would require relocation of the existing tracks eastward, affecting Caltrain and Amtrak service during the several days of connecting existing track and new track.
- **Monterey Corridor Subsection**—Alternative 1 would cross over the UPRR right-of-way where it enters Monterey Road near Fehren Drive with potential for several-day closures (on weekends if feasible) that would affect Caltrain and Amtrak service.
- **Morgan Hill and Gilroy Subsection**—Alternative 1 would cause no major disruptions except at the Downtown Gilroy Station where the UPRR tracks would be relocated from just north to south of the station, which may result in several days of disruption to Caltrain and Amtrak service.
- **Pacheco Pass Subsection and San Joaquin Valley Subsection**—Alternative 1 would not disrupt passenger rail service east of Gilroy.

Alternative 2 would include the following locations of potential disruption to passenger rail operations:

- **Entire route**—Alternative 2 would relocate utilities at discrete locations, but this is not expected to result in delay or closure of passenger rail service.
- **San Jose Diridon Station Approach Subsection**—Alternative 2 would require relocation of two tracks, MT-1 and MT-2 from just south of Scott Boulevard to CP Coast and relocation of three tracks, MT-1, MT-2, and MT-3 from CP Coast to just south of I-880. During connection of the existing tracks to the new tracks, there may be a shutdown of the existing track for 1 to 2 days (on weekends if feasible), which would affect Caltrain, ACE, Amtrak, and Capitol Corridor service. At San Jose Diridon Station and south of the station, Alternative 2 would have the same impacts as Alternative 1.
- **Monterey Corridor Subsection**—Alternative 2 would cross over the UPRR right-of-way when it enters Monterey Highway near Fehren Drive with potential for closures of 1 to 2 days (on weekends if feasible). Alternative 2 would include grade separations that cross the UPRR right-of-way at Skyway Drive, Branham Avenue, and Chynoweth Avenue, each of which would result in 1- to 2-day closures (on weekends if feasible). Alternative 2 would also require the temporary relocation of the Caltrain Capitol and Blossom Hill Stations. Temporary stations would be built along the Caltrain right of way in adjacent/nearby areas prior to closure of the existing station and shoofly tracks (bypass tracks) would be built at the existing stations. The temporary stations would be in operation for 1 to 3 years. In south San Jose south of Menard Avenue from UPRR MP 58.1 to MP 59.4 at the PG&E Metcalf Station,

approximately 1.3 miles of the UPRR tracks would be realigned. Caltrain and Amtrak service would be closed for several days during connection of the new tracks to the existing tracks.

- **Morgan Hill and Gilroy Subsection**—Alternative 2 would require the temporary relocation of the Caltrain Morgan Hill, San Martin, and Gilroy Stations. Temporary stations would be built along the Caltrain ROW in nearby/adjacent areas prior to closure of existing stations and shoofly tracks (bypass tracks) would be built at the existing stations. Alternative 2 would include grade separations that cross the UPRR right-of-way at 18 locations,[23] each of which would result in 1- to 2-day closures (on weekends if feasible). Alternative 2 would also require track relocation in the following areas: approximately 1.8 miles of tracks from south of Maple Avenue (near UPRR MP 69.5) to just south of San Martin Avenue (near MP 71.3); approximately 1.5 miles of UPRR tracks from south of Cohansey Avenue (near MP 75.1) to IOOF Avenue (between MP 76.6 and 76.7); and approximately 1.4 miles from 6th Street (MP 77.1) to south of US 101 (approximately MP 78.5). Caltrain and Amtrak service would be closed for several days at each track realignment location during connection of the new tracks to the existing tracks.
- **Pacheco Pass Subsection and San Joaquin Valley Subsection**—Alternative 2 would not disrupt passenger rail service south or east of Gilroy.

Alternative 3 would include the following locations of potential disruption to passenger rail operations:

- **Entire route**—Alternative 3 would include some utility relocation work at discrete locations, but this is not expected to result in delay or closure of passenger rail service.
- **San Jose Diridon Station Approach Subsection**—Alternative 3 would have the same impacts as Alternative 2.
- **Monterey Corridor Subsection**—Alternative 3 would have the same impacts as Alternative 1.
- **Morgan Hill and Gilroy Subsection**—Alternative 3 would not cause major disruptions to passenger rail service.
- **Pacheco Pass Subsection and San Joaquin Valley Subsection**—Alternative 3 would not disrupt passenger rail service east of Gilroy.

Alternative 4 would include the following locations of potential disruption to passenger rail operations:

- **Entire route**—Alternative 4 would include some utility relocation work at discrete locations, but this is not expected to result in delay or closure of passenger rail service.
- **San Jose Diridon Station Approach Subsection**—North of San Jose Diridon Station (De La Cruz Boulevard to Santa Clara Street), Alternative 4 would include a new dedicated freight track between CP Coast and CP Shark, the construction of which may result in periodic disruption to passenger service on adjacent tracks. The College Park station would be rebuilt and San Jose Diridon Station would be modified. From San Jose Diridon Station to CP Lick (Park Ave to Daylight Way), Alternative 4 would convert the current double-track corridor to three tracks with a single dedicated track for freight, ACE, Amtrak, and Capitol Corridor and two electrified tracks under a cantilever overhead contact system (OCS) for Caltrain and HSR. This track configuration will maintain current capacity for UPRR, ACE, Amtrak, and Capitol Corridor and the planned increases for Caltrain with the Peninsula Corridor Electrification Project and the

[23] Palm Avenue, Live Oak Avenue, Madrone Parkway, East Dunne Avenue, Barrett Avenue, San Pedro Avenue, Tennant Avenue, East Middle Avenue, East San Martin Street, Oak Street, Church Avenue, Masten Avenue, Leavesley Road, IOOF Avenue, Lewis Street, 6th Street, Old Gilroy Street, and 10th Street.

proposed HSR service. Bridges over Bird Avenue and Delmas Avenue would be modified to accommodate three tracks. The Michael Yard would be reconfigured.

- **Monterey Corridor Subsection**—Between CP Lick and CP Coyote, Alternative 4 would convert the corridor to a single dedicated freight track and two electrified tracks under OCS, which would require track shifts. The Caltrain Capitol and Blossom Hill Stations would be rebuilt.
- **Morgan Hill and Gilroy Subsection**—Alternative 4 would convert the corridor to a single dedicated freight track and two electrified tracks under OCS, requiring track shifts. Alternative 4 would replace the rail bridge across the Upper Llagas Creek floodway. The Caltrain Morgan Hill and San Martin Stations would be rebuilt. Alternative 4 would include reconfiguration of the Gilroy station to accommodate UPRR, HSR, Caltrain, Amtrak, and TAMC, and would add a freight rail spur to supply HSR maintenance facility.
- **Pacheco Pass Subsection and San Joaquin Valley Subsection**—Alternative 4 would not disrupt passenger rail service east of Gilroy.

The contractor would attempt to minimize disruption to passenger rail facilities or shorten the length of time that these facilities would be inoperable. To minimize conflicts with passenger rail transit caused by construction, the contractor would repair any damaged sections to the equivalent of their original structural condition or better and would implement scheduling and the use of existing alternative tracks where available. As noted in Alternative 2, contractors will construct a shoofly track, a temporary track that allows trains to bypass construction sites (TR-IAMF#9) for the temporary relocation of the Caltrain Capitol, Blossom Hill, Morgan Hill, San Martin, and Gilroy Stations. When connecting existing tracks to shoofly tracks, there may be a temporary period of service disruption. The temporary disruption would occur over several hours to several days. Where feasible, the contractor would schedule cessation of passenger rail service during the night or on weekends to minimize disruption of passenger rail service. Upon completion, HSR contractors would open and repair tracks or construct new mainline track, and remove the temporary shoofly track.

The contractor will identify specific measures in the CMP (TR-IAMF#11) to maintain transit access and safe and adequate access for transit users during construction activities. In addition, the CTP will include methods to minimize construction traffic. A traffic control plan developed as part of the CTP will include provisions for maintaining traffic flow and access and minimizing operations hazards through alternative access and detour provisions, routes for construction traffic, and scheduled transit access. The contractor will establish construction truck routes, restrictions on construction hours, and construction parking as part of the CTP. While implementation of the CMP would control passenger rail operations and minimize disruption, there would still be residual disruptions to passenger rail operation at times.

CEQA Conclusion

The impact under CEQA related to temporary disruption would be significant for all four project alternatives because of the disruptions expected in the San Jose Diridon Station Approach Subsection that would decrease the performance of multiple public transit systems. In addition, Alternative 2 would also have significant disruptions in the Monterey Corridor and Morgan Hill and Gilroy Subsections. The contractor will minimize disruption to passenger rail transit through construction of new or alternative tracks to continue service, maintenance of transit access, and implementation of traffic control measures to maintain traffic flow and access. Despite these measures, construction will still disrupt passenger rail operations in the San Jose Diridon Station Approach (all alternatives) and the Monterey Corridor and Morgan Hill and Gilroy Subsections (Alternative 2). Temporary construction conditions would materially decrease the performance of passenger rail operations. Mitigation measures to address this impact are identified in Section 3.2.9, CEQA Significance Conclusions. Section 3.2.7, Mitigation Measures, describes these measures in detail.

Impact TR#12: Permanent Impacts on Bus Transit

Project construction would require modifications and closures throughout the roadway network to accommodate the stations, platforms, track alignment, and MOWFs. The permanent road closures and relocations are described in detail under Impact TR#4.

Permanent road closures and reduction in roadway capacity on Monterey Road would shift vehicle trips and reduce capacity along high-frequency VTA bus routes (routes with service every 15 minutes or less), contributing to bus performance delay for VTA's bus services. These changes, implemented for Alternatives 1, 2, and 3, would redirect traffic in the area, affecting five high-frequency bus routes on Monterey Road. Project-related roadway modifications would contribute to delay for all VTA bus routes that operate on Monterey Road, including Routes 522, 64, 66, 68, and 70. The project-related roadway modifications would affect bus on-time performance and operating speeds. The reduction in the number of travel lanes on Monterey Road between Capitol Expressway and Blossom Hill Road, consistent with the *Envision: San José 2040 General Plan* (City of San Jose 2018), would reduce the capacity of Monterey Road. Alternative 4 would not reduce the number of travel lanes on Monterey Road and would not affect these bus routes in the Monterey Corridor. In the Downtown Gilroy Station area, Alternative 4 would affect high-frequency VTA bus route 68 through project-related roadway closures.

CEQA Conclusion

The impact under CEQA would be significant for Alternatives 1, 2, and 3 because the project would decrease the performance of five high-frequency bus routes and would be significant under Alternative 4 because the project would decrease the performance of one high-frequency bus route. Mitigation Measures to address this impact are identified in Section 3.2.9, CEQA Significance Conclusions. Section 3.2.7, Mitigation Measures, describes these measures in detail.

Operations Impacts

Impact TR#13: Continuous Permanent Impacts on Bus Services

For the 2029 and 2040 Plus Project conditions, the project would be fully operational. Vehicle trips around the stations would increase because of the addition of HSR passengers and workers traveling to and from station areas. This added traffic would lead to increased volumes, congestion, and delays around San Jose Diridon Station and the Gilroy station. As population and employment would continue to increase between 2029 and 2040, the 2029 No Project conditions would have lower traffic volumes and shorter delays than in 2040. Implementation of the Monterey Road road diet under Alternatives 1, 2, and 3 would reduce capacity on Monterey Road and adjacent roadways, leading to congestion and delays at intersections along Monterey Road and along adjacent roadways. Gate down time at the at-grade crossings under Alternative 4 would increase delay on routes that travel through at-grade crossings. There would be no change to HSR train operations at any at-grade crossing compared to the alternatives without the DDV and TDV because the speed changes would not occur at any alignment areas with grade crossings; as a result, there would be no changes in traffic effects relative to at-grade crossings.

As detailed in impact TR#7, 27 intersections would operate at LOS E or F in the Monterey Corridor Subsection in the 2029 Plus Project conditions versus 31 in the 2040 Plus Project conditions.

The increased congestion and delay would occur along high-frequency VTA bus routes (routes with service every 15 minutes or less), contributing to bus performance delay for VTA's services. The addition of project-related vehicle trips would affect bus on-time performance and operating speeds. All project alternatives would add project-related trips affecting 10 high-frequency bus routes near San Jose Diridon Station, Monterey Road, and the Gilroy station. Alternative 4 would add gate down time, further affecting one high-frequency bus route in the Monterey Corridor Subsection. Alternatives 1 and 3 would have comparable impacts, while Alternative 2 would have slightly greater impacts on the affected bus routes from higher overall levels of delay at study intersections. Table 3.2-19 shows Plus Project bus performance delay impacts from vehicle trips. The same bus routes would be affected in the 2029 and 2040 Plus Project conditions.

Table 3.2-19 Plus Project Bus Performance Delay Impacts from Vehicle Trips

Subsection	Affected Bus Routes	Alternative
San Jose Diridon	VTA Routes 181, 22, 64, 72, 73, DASH	1, 2, 3 and 4
Monterey Corridor	VTA Routes 522, 64, 66, 68, 70	1, 2, 3 and 4
Monterey Corridor	VTA Route 73	4
Morgan Hill and Gilroy	VTA Routes 64, 66, 68, 70	1, 2 and 4

Source: Authority 2019a
VTA = Santa Clara Valley Transportation Authority

CEQA Conclusion
The impact under CEQA would be significant for all four project alternatives because increased delays at intersections caused by the project would contribute to increased delays on 10 high-frequency bus routes predominantly in San Jose, affecting the performance of bus operations. Mitigation measures to address this impact are identified in Section 3.2.9, CEQA Significance Conclusions. Section 3.2.7, Mitigation Measures, describes these measures in detail.

Impact TR#14: Continuous Permanent Impacts on Passenger Rail and Bus Access

For the 2029 and 2040 Plus Project conditions, the project would be fully operational. Transit, nonmotorized, and vehicle trips around the stations would increase because of the addition of HSR passengers and workers traveling to station areas. Most of these trips would occur during peak hours. The project would generate approximately 700 peak hour transit trips at San Jose Diridon Station, approximately 130 peak hour transit trips at the Downtown Gilroy Station, and approximately 30 peak hour trips at the East Gilroy Station in 2029. In 2040, the project would generate approximately 1,200 peak hour transit trips at San Jose Diridon Station, approximately 230 peak hour transit trips at Downtown Gilroy Station, and approximately 50 peak hour trips at East Gilroy Station. These project-generated transit trips, when added to the non-project–related nonmotorized and vehicle trips around the station areas and transit riders not accessing HSR, create additional demand for station facilities.

Station design would take into account the changes in demand and would provide access for passengers using HSR as well as other bus and passenger rail services. The Authority would work with Caltrain, ACE, Capitol Corridor, VTA, and Amtrak during station design to provide adequate access to all passenger rail and bus services. The project would have dedicated HSR platforms at San Jose Diridon Station and the Gilroy station and thus would have no impact during operations on platform access for other passenger rail services. Project design plans would sufficiently accommodate the operational needs of all modes for affected transportation facilities in the project footprint. By designing for all modes of transportation, including bus and rail transit, these project features will provide permanent adequate access for all passengers in the station area. Alternative 4 would provide improvements to the Caltrain system that are not provided in Alternatives 1, 2 and 3, including electrified rail south of Tamien and reconstructed Caltrain stations.

CEQA Conclusion
The impact under CEQA would be less than significant for all four project alternatives. Passengers for other passenger rail and bus services would be able to access these services unimpeded. Therefore, CEQA does not require mitigation.

Impact TR#15: Continuous Permanent Impacts on Transit Ridership

Because all project alternatives would have the same operational LOS and ridership, the impact analysis applies equally to all alternatives.

HSR riders at HSR stations would create new demands for Caltrain and other transit systems because of transfer from HSR to reach destinations served by these other systems. In addition, HSR would compete with Caltrain for riders from Gilroy and San Jose northward. This analysis

focuses on the impacts on systemwide transit ridership and potential secondary physical impacts from transit system improvements to address changes in ridership. Because HSR ridership and service would be greater in 2040 than in 2029, the 2040 analysis serves as a conservative estimate of impacts.

The Authority modeled transit access and egress for HSR passengers from San Jose Diridon Station for 2029 and 2040 and for the Gilroy station options for 2029 and 2040 using the California Statewide Travel Demand Model (Caltrans 2018). As shown in Table 3.2-3, the increase in HSR service over time would result in increased use of connecting transit systems.

The Authority also modeled 2040 Caltrain system ridership using the same model. The Authority modeled both the increase in demand for transfers between Caltrain and HSR and the competitive impact of parallel Caltrain and HSR service to Gilroy, San Jose, Millbrae, and San Francisco. As shown in Table 3.2-20, in 2040, HSR service would result in a net increase in Caltrain ridership by 6.5 percent compared to 2040 No Project conditions.

Table 3.2-20 Changes in Caltrain System Average Weekday Ridership, 2040 Plus Project 2040

Transit System	Existing	2040 No Project	2040 Plus Project	Percent Change Between 2040 No Project and Plus Project
Caltrain[1,2]	62,190	114,527	121,930	6.5

[1] Existing results from Caltrain 2017 ridership report (Caltrain 2017).
[2] 2040 estimates from HSR Statewide Model results for an HSR medium-ridership scenario, using Caltrain Peninsula Corridor Electrification Project EIR assumptions for Caltrain and BART fares and LOS (PCJPB 2015). The statewide model produces results in average daily ridership of 89,049 for 2040 No Project and 94,805 for 2040 Plus Project, which analysts then converted to average weekday ridership based on comparison of the 2016 ratio between average daily and average weekday ridership.
BART = Bay Area Rapid Transit
EIR = environmental impact report
HSR = high-speed rail
LOS = level of service
PCJPB = Peninsula Corridor Joint Powers Board

The primary source of increase to Caltrain ridership would be the increase in HSR riders at San Jose Diridon Station, followed by HSR riders at the Gilroy Station. HSR would have fewer stops than Caltrain service between Gilroy, San Jose, Millbrae, and San Francisco and thus would have shorter travel times, which may result in some Caltrain commuters shifting to HSR to these limited destinations. However, Caltrain would continue to provide service to the five non-HSR stations between Gilroy and San Jose and 24 stations between San Jose and San Francisco and would likely continue to have lower fares. Caltrain would also serve as a feeder service to and from HSR for passengers along the Caltrain service route to access statewide travel with HSR. Overall, the addition of HSR to the corridor from Gilroy to San Jose (and on to San Francisco) would add passenger rail service capacity. It is expected over time that an equilibrium would be reached between Caltrain and HSR service based on the different services that each provides.

The primary source of increase to VTA and BART system ridership would be the increase in HSR riders at San Jose Diridon Station using the existing VTA connections (light rail and bus) and the presumed future BART extension to San Jose Diridon Station. HSR fares would be higher than competing transit services but would provide time savings for some regional commutes. HSR would be competitive with other transit services in time, but not price. HSR would have limited competitive impact on VTA's bus service, because it would be limited to competing with regional bus connections between Gilroy and San Jose, where minimal time savings are achieved. HSR should pose no competition to VTA's light-rail service, as HSR would not serve any of its light-rail destinations other than San Jose Diridon Station. HSR would pose some competition with BART by providing a more direct connection from San Jose to San Francisco, whereas BART service to San Francisco would be via the East Bay. As shown, bus and rail use are expected to increase over time with project operations.

Growth in the region by 2040 would increase demand for increased transit service. HSR is one of many projects in the planning phase to address that increased demand. HSR service would result

in increased ridership for other transit feeder systems. If excess capacity is available for other transit service providers, the introduction of new riders would have a net benefit by increasing farebox revenue. Systems that operate at capacity may require changes in service levels and additional transit vehicles. Transit providers must plan for their future needs and build the facilities to meet their system rider demands as feasible given funding availability. Thus, project operations may increase ridership on other transit systems, but would not materially harm the ability of other transit providers to serve their customers and would not conflict with adopted policies, plans, or programs regarding public transit, or otherwise materially decrease the performance of such facilities.

A second concern is whether physical improvements on other transit systems would be needed to accommodate HSR-induced transit ridership and whether they would result in physical impacts on the environment. Caltrain facilities already contain multimodal access and thus the 6.5 percent increase in system ridership should not result in substantial new capital improvements for Caltrain stations beyond what is planned without HSR service. A similar conclusion applies for VTA and BART.

It is not anticipated that the relatively modest increases in HSR-induced ridership for other transit services would require the construction of substantial additional transit infrastructure. Secondary impacts from construction of limited amounts of additional facilities (such as bus stops/shelters) at existing rail, light rail, and bus facilities are not expected to result in secondary environmental impacts; however, improvements by other transit agencies would be the subject of independent environmental analysis.

CEQA Conclusion

The impact under CEQA would be less than significant for all four project alternatives. The project would increase the demand for Caltrain and other transit services, which would enhance the financial viability of these public transit services where excess capacity is available. The project would not materially harm the ability of other transit services to serve their customers and would not conflict with adopted policies, plans, or programs regarding public transit, or otherwise materially decrease the performance of such facilities. Transit service expansions would result in limited physical improvements not likely to result in secondary environmental impacts. Therefore, CEQA does not require mitigation.

Impact TR#16: Continuous Permanent Impacts on Passenger Rail System Capacity

For the 2029 and 2040 Plus Project conditions, the project would be fully operational. All stations, platforms and track alignments would be built and in use.

Most of the Alternatives 1, 2, and 3 alignments would be on dedicated tracks that would not affect other passenger rail systems. For these alternatives, only a small portion of the alignment would be shared by HSR and other passenger rail systems. Under Alternatives 2 and 3, HSR would have dedicated tracks for the entire project extent, from Merced to Scott Boulevard. Under Alternative 1, HSR would have dedicated tracks from Merced to just south of I-880 in San Jose, where HSR would transition to blended service on shared tracks (MT-2 and MT-3) with Caltrain from I-880 to Scott Boulevard. Under Alternative 4, HSR and Caltrain would have blended operations between Gilroy and San Jose and between San Jose and San Francisco. The project would have no impact on capacity for other passenger rail operations (ACE, Capitol Corridor, Amtrak) as these other services all use MT-1; although MT-1 would be relocated as necessary to accommodate the project, the track would remain after construction for operational use for passenger and rail operations, and the project would not diminish the available capacity.

The Authority evaluated blended service with Caltrain between San Jose and San Francisco using operational modeling for the San Francisco to San Jose Project Section (Authority 2017). The analysis focused on the blended service between I-880 and Scott Boulevard under Alternative 1. The model has shown that average Caltrain service times between San Francisco and San Jose would be nearly the same with blended service as without any HSR trains for an alternative without a passing track. Caltrain average service would be approximately 2.5 minutes slower for an alternative with the Short-Middle-4 passing track option.[24] The addition of HSR trains would result in some supplemental time (from 4.8 to 7.6 minutes) for Caltrain trains that may be negatively perceived by Caltrain riders. However, the operations results show that the blending of service between I-880 and Scott Boulevard under Alternative 1 for this project would not result in a substantial increase of Caltrain average service times.

Terminology

Supplemental time refers to the time when Caltrain is waiting at a station or operating at less-than-optimal speed to provide time for passing HSR trains.

The operations impact analysis also examined whether blended service between San Jose and San Francisco would allow Caltrain to operate a regular interval service and avoid bunching of trains. Caltrain would be able to operate northbound and southbound trains at regular hourly times. With the no passing track option in the San Francisco to San Jose Project Section, there would be no substantial bunching of Caltrain service. With the San Francisco to San Jose Project Section Short-Middle-4 passing track option, there would be slightly more bunching than under the No Project Alternative or the option with no passing tracks.

With Alternative 4, HSR and Caltrain would have blended operations between San Jose and Gilroy in addition to those between San Jose and San Francisco. The Authority analyzed the impact of blended operations on Caltrain passenger service between Gilroy and San Jose (Authority 2018b). At present, Caltrain operates three northbound trains from Gilroy in the morning that stop at the San Martin, Morgan Hill, Blossom Hill, Capitol, and Tamien Stations prior to reaching San Jose Diridon Station and three southbound trains that stop at all of these stations on the way to Gilroy in the evening. The morning trains depart Gilroy between 6:10 and 7:10 a.m. and the evening trains depart Gilroy between 4:45 and 7:15 p.m. With blended service, there would be up to seven HSR trains per direction per peak hour between San Jose and Gilroy. As noted, Alternative 4 would include two dedicated tracks between San Jose and Gilroy for the exclusive use of HSR and Caltrain. These two tracks would provide capacity for up to 12 trains per peak hour per direction, based on Authority modeling, which would leave up to four trains per peak hour per direction for Caltrain service. Thus, there would be adequate capacity to match current levels of Caltrain train service.

Alternative 4 would require a change in the Caltrain stopping pattern because HSR trains would operate up to 110 miles per hour under this alternative between Gilroy and San Jose and no siding tracks would be installed in this section for HSR or Caltrain use. Instead of every train stopping at every station between Gilroy and Tamien, a skip-stop pattern would be used by Caltrain in order to increase Caltrain transit times, which would allow HSR trains to operate more efficiently. In order to maintain the number of current stops at each Caltrain station between Gilroy and Tamien (e.g., three trains in the morning and three trains in the evening), Caltrain service would increase to six trains in the morning and six trains in the evening with up to four trains per peak hour per direction. Because existing levels of Caltrain service would be maintained, including the amount of stops at each Caltrain station, Caltrain capacity would be maintained and would actually expand compared to existing conditions. In addition, with electrification of the blended tracks, Caltrain would be able to extend electric multiple unit operations to Gilroy, which would decrease Caltrain service times compared to existing conditions.

[24] The passing track options are evaluated in San Francisco to San Jose Project Section EIR/EIS.

The analysis of blended operations (including up to six HSR trains per peak hour per direction and up to four Caltrain trains per peak hour per direction) also included an analysis of the capacity of San Jose Diridon Station to accommodate HSR service, Caltrain service, and service for the other passenger railroads (Capitol Corridor, Amtrak, and ACE) (Authority 2018b). With the two proposed dedicated platforms for HSR, there would remain adequate platform capacity on the other four platforms to serve Caltrain (up to six trains per hour per direction), ACE (up to four trains per hour per direction), and Capitol Corridor (up to two trains per peak hour). Amtrak only has two trains per day, does not have the same platform capacity needs as the peak-hour services, and can also be accommodated. The analysis of operations regarding track capacity (Authority 2018b) also concluded that there would be adequate track capacity for ACE operations (up to four trains per hour per direction) on the nonelectrified track between San Jose Diridon Station and the Michael Yard south of the Tamien Station and that Capitol Corridor could continue its current practice of daytime layover at the Diridon platform.

CEQA Conclusion

The impact under CEQA would be less than significant for all four project alternatives. The project would not result in a substantial increase in Caltrain average service times relative to the blending of service. Caltrain would be able to operate a regular interval schedule without substantial bunching. The project would not conflict with adopted policies, plans, or programs regarding public transit, or otherwise materially decrease the performance of passenger rail. Therefore, CEQA does not require mitigation.

3.2.6.5 Nonmotorized Travel

Project construction and operations would result in temporary and permanent impacts on nonmotorized travel. Project construction would disrupt bicycle and pedestrian facilities in the project footprint. Project operations would increase the number of station passengers and would change the demand for bicycle and pedestrian facilities that service the shared stations at San Jose Diridon Station and the Gilroy station.

No Project Conditions

The population under the No Project conditions is projected to increase through 2029 and 2040. Development projects to accommodate projected population growth, including residential, commercial, industrial, recreational, and transportation projects, would continue under the No Project Alternative and would result in impacts on bicyclist and pedestrian transportation, including changes to bicycle and pedestrian access.

The No Project Alternative includes the implementation of bicycle and pedestrian projects from plans identified in Section 3.2.4, Method for Evaluating Impacts. These projects include the implementation of bike lanes or trails, and pedestrian sidewalk, crosswalk, and signal timing enhancements. Table 3.2-21 shows the active transportation improvement projects that would be constructed by 2029 and 2040 in the transportation RSA.

Table 3.2-21 No Project Conditions Bicycle and Pedestrian Improvements

Subsection or Station	Pedestrian Projects	Bicycle Projects
San Jose Diridon Station	Enhanced underpass connections along SR 87 and Caltrain underpasses. Pedestrian scramble[1] at the intersection of Santa Clara Street and Montgomery Avenue. Sidewalk and crosswalk enhancements around station area.	Class I bike trail extensions of Los Gatos Creek Trail and North Autumn Street Connection (Santa Clara to Julian), including grade-separated trail crossings along Los Gatos Creek Trail. Class II bike lanes on Autumn Street, Montgomery Street, The Alameda, Race Street, Julian Street, and Auzerais Avenue.

Subsection or Station	Pedestrian Projects	Bicycle Projects
Monterey Corridor	No changes	Class II bike lanes on Monterey Road between Metcalf Road and Bailey Avenue. Class III bike route on Roeder Road at Monterey Road.
Morgan Hill and Gilroy: Downtown Gilroy Station	No changes	No changes
Morgan Hill and Gilroy: East Gilroy Station	Extension of sidewalks along Leavesley Avenue	Extension of bike lanes along Leavesley Avenue.

Sources: City of Gilroy 2002; City of San Jose 2009, 2014.
[1] A pedestrian scramble is a type of traffic signal phasing that temporarily stops all vehicular traffic and allows pedestrians to cross an intersection in every direction, including diagonally, at the same time.
SR = state route

Project Impacts

Construction Impacts

Impact TR#17: Temporary Impacts on Pedestrian and Bicycle Access

Construction activities associated with station, MOWF, platform, and track alignment construction would result in temporary roadway lane or road closures, underground utility work, and disruption of transportation systems operations in urban areas. Construction activities associated with the station, platform, and track alignment would require TCEs, which would result in the temporary closure of pedestrian or bicycle facilities. Any closure or removal of pedestrian facilities, bicycle lanes, and paths during construction would be temporary.

Alternatives 1, 2, and 3 would have more effects than Alternative 4 in the Monterey Corridor Subsection. The lane narrowing on Monterey Road under Alternatives 1, 2, and 3 would result in more temporary loss of access for cyclists and pedestrians than Alterative 4, which does not require lane narrowing.

Temporary closure of bicycle and pedestrian facilities would result in a loss of access for cyclists and pedestrians in the area of the closure. An attempt would be made to minimize the removal of pedestrian and bicycle facilities and to shorten the length of time that these facilities are inoperable. Upon completion of construction, all pedestrian facilities and bicycle lanes would be restored. To minimize construction impacts on bicycles and pedestrians, the contractor will prepare specific CMPs (TR-IAMF#4 and TR-IAMF#5) to address maintenance of pedestrian and bicycle access during construction activities. To maintain pedestrian and bicycle access, the contractor will provide a technical memorandum (TR-IAMF#12), which will describe how pedestrian and bicycle accessibility will be provided and maintained across the HSR corridor, to and from stations, and on station property. Access to community facilities for vulnerable populations would be maintained or enhanced.

To reduce access conflicts caused by construction, the contractor will prepare a CTP (TR-IAMF#2). The CTP, which will be reviewed and approved by the Authority, will address in detail the activities to be carried out in each construction phase. The CTP will provide a traffic control plan to identify when and where temporary closures and detours will occur, with the goal of maintaining traffic flow, especially during peak travel periods. The traffic control plan will be developed for each affected location and will include, at a minimum, signage to alert pedestrians to the construction zone, traffic control methods, traffic speed limitations, provisions for safe pedestrian and bicycle passage or convenient detours, and safe pedestrian access to local businesses and residences.

CEQA Conclusion
The impact under CEQA would be less than significant for all four project alternatives because the project would not conflict with adopted policies, plans, or programs regarding bicycle or

pedestrian facilities, or otherwise materially decrease the performance of such facilities. The contractor would prepare CMPs, which would maintain safe and adequate access for pedestrians and cyclists during construction. A CTP would be developed containing standard construction procedures related to traffic management, including development of a detailed traffic control plan for each affected location prior to beginning any construction activities. Pedestrian and bicycle accessibility would be maintained and would be prioritized over motor vehicle access. The traffic control plan would include efforts to maintain safe and adequate pedestrian and bicycle access through signage to alert pedestrians to the construction zone, traffic control methods, traffic speed limitations, provisions for safe pedestrian and bicycle passage or convenient detours, and safe pedestrian access to local businesses and residences. Therefore, CEQA does not require mitigation.

Impact TR#18: Permanent Impacts on Pedestrian and Bicycle Access

Project construction would require changes to the pedestrian and bicycle facilities in the HSR station areas that would have permanent impacts. There would also be a substantial number of pedestrian and bicycle facilities being rebuilt, permanent roadway closures and relocations, and roadways that would require repairs or reconstruction because of damage during construction. The permanent road closures and relocations are described in detail under Impact TR#4.

Changes to the pedestrian and bicycle facilities in HSR station areas and on roadways changed or reconstructed by the project would provide safe and accessible connections. In the San Jose Diridon Station area, new bike facilities to access the station would be provided on Cahill Street between Santa Clara Street and Park Avenue and on various local streets between the Alameda and Park Avenue. In the Downtown Gilroy Station area, new bike facilities would be provided on 7th Street between Monterey Road and Alexander Street, on Monterey Road between 6th Street and Ervin Court, on Forest Street between 8th Street and 10th Street, and on Alexander Street between 7th Street and 10th Street. In the East Gilroy Station area, new bike facilities would be provided on Leavesley Road from the outlet mall to Marcella Avenue. These new facilities in the Downtown Gilroy Station area and East Gilroy Station area would provide station access for bikes. Designated bike parking areas would also be provided for all station areas.

To maintain pedestrian and bicycle access, project design plans will include specifications for vehicle lanes, passenger loading zones, sidewalks, crosswalks, bike lanes, trails, bus stops, parking, and intersection controls (TR-IAMF#12). These will address how pedestrian and bicycle accessibility will be provided and maintained across the HSR corridor, to and from stations, and on station property. Local access programs, such as Safe Routes to Schools, would be maintained or enhanced. Access to community facilities for vulnerable populations would be maintained or enhanced. All reconstructed roadways would replace all bicycle and pedestrian facilities upon completion of construction. All new and replaced facilities would be designed with specifications for passenger loading zones, sidewalks, crosswalks, bike lanes, trails, bus stops, parking, and intersection controls. Project designs would work to incorporate best practice multimodal design standards and guidance from the American Association of State Highway and Transportation Officials, the National Association of City Transportation Officials, and the Institute of Transportation Engineers.

CEQA Conclusion

The impact under CEQA would be less than significant for all four project alternatives because the project would not conflict with adopted policies, plans, or programs regarding bicycle or pedestrian facilities, or otherwise materially decrease the performance of such facilities. The project would provide safe and accessible bike and pedestrian facilities. For all reconstructed roadways, all bicycle and pedestrian facilities would be replaced upon completion of construction to maintain nonmotorized access. Pedestrian and bicycle accessibility would be provided and maintained and would be prioritized over motor vehicle access. Thus, the project would not materially decrease the performance of pedestrian and bicycle facilities. Therefore, CEQA does not require mitigation.

Operations Impacts

Impact TR#19: Continuous Permanent Impacts on Pedestrian and Bicycle Access

For the 2029 and 2040 Plus Project conditions, the project would be fully operational. Transit, nonmotorized, and vehicle trips around the stations would increase because of the addition of passengers and HSR workers traveling to station areas. The project would generate approximately 450 peak hour nonmotorized trips at San Jose Diridon Station, approximately 110 peak hour nonmotorized trips at the Downtown Gilroy Station, and approximately 10 peak hour trips at East Gilroy Station in 2040. The planned station area facilities would be designed to adequately serve forecasted volumes of nonmotorized traffic.

To maintain pedestrian and bicycle access, project design plans will include specifications for vehicle lanes, passenger loading zones, sidewalks, crosswalks, bike lanes, trails, bus stops, parking, and intersection controls (TR-IAMF#12). These will describe how pedestrian and bicycle accessibility will be maintained across the HSR corridor, to and from stations, and on station property. Local access programs, such as Safe Routes to Schools, would be maintained. Access to community facilities for vulnerable populations would be maintained or enhanced as new facilities are added at stations. Bicycle and pedestrian facilities would be replaced upon completion of reconstructed roadways. All new and replaced facilities would be designed with specifications for passenger loading zones, sidewalks, crosswalks, bike lanes, trails, bus stops, parking, and intersection controls. Project design plans would incorporate best practice multimodal design standards and guidance from the American Association of State Highway and Transportation Officials, the National Association of City Transportation Officials, and the Institute of Transportation Engineers.

CEQA Conclusion

The impact under CEQA would be less than significant for all four project alternatives because the project would not conflict with adopted policies, plans, or programs regarding bicycle or pedestrian facilities, or otherwise materially decrease the performance of such facilities. The project would provide safe and accessible bike and pedestrian facilities. All roadways that are reconstructed would replace all bicycle and pedestrian facilities upon completion of construction. This would maintain or enhance nonmotorized access. Facilities would be designed to latest standards and guidance and would provide adequate access. Pedestrian and bicycle accessibility would be provided and maintained and would be prioritized over motor vehicle access. Thus, the project would not materially decrease the performance of pedestrian and bicycle facilities. Therefore, CEQA does not require mitigation.

3.2.6.6 Freight Rail Service

Project construction would temporarily disrupt freight service where freight tracks would be modified. Project operations would increase the amount of passenger trains using tracks shared by passenger trains and freight trains from Santa Clara north. The project would also modify overhead electrical lines installed by Caltrain under the Peninsula Corridor Electrification project from Santa Clara north.

No Project Conditions

Population, employment, and economic activity in Santa Clara, San Benito, and Merced Counties will increase through 2029 and 2040. Development projects to accommodate projected population growth and economic growth, including residential, commercial, industrial, recreational, and transportation projects, would continue under the No Project Alternative and would result in increased demands for transport of freight by rail and the resulting need to expand freight services.

The exact amount of freight rail transport is difficult to predict. Freight levels depend on not only the overall level of economic activity but also the specific demand for bulk and oversize commodities that dominate freight carried by rail. The estimates for future freight levels for the freight line from San Francisco to San Jose and from San Jose to Gilroy are based on the freight forecast in the most recent California State Rail Plan from 2018, which includes annual growth per annum of 2.6 percent between Santa Clara and San Francisco, 1.5 percent between San

Jose and Santa Clara, and 2.6 percent south of San Jose to Gilroy (Caltrans 2018).[25] Table 3.2-22 shows existing and assumed future freight levels along different parts of the project extent.

Table 3.2-22 Existing and Assumed Future Freight Train Operations

Year	Time Period	Total Daily Number of Trains (Both Directions) per Segment				
		Lawrence–Santa Clara	Santa Clara–Diridon	Diridon–Tamien	Tamien–Gilroy	South of Gilroy
2019[1]	Total	4	8	4	4	4
2029[2]	Total	5	9	5	5	5
2040[2]	Total	7	12	7	7	7

Source: Authority 2019a
[1] Caltrain Corridor – based on Caltrain Dispatch Data for 2019 (PCJPB 2019); assumed freight levels on UPRR south of Tamien same as north of Tamien
[2] Assumed annual growth per annum based on 2018 State Rail Plan estimates for Northern California freight volumes of 2.6 percent between Santa Clara and San Francisco, 1.5 percent between San Jose and Santa Clara, and 2.6 percent south of San Jose to Gilroy (Caltrans 2018).
UPRR = Union Pacific Railroad

In the project extent, the section from San Jose Diridon Station to CP Coast (just north of the Santa Clara Caltrain Station) is a pinch point for rail services, including freight rail, as freight from the south (via the Coast Subdivision), the southwest (via the Vasona Industrial Lead), the north (via the Caltrain Corridor), and the northeast (Coast Subdivision and Warm Springs Subdivision) all traverse the Caltrain Corridor in a 3.1-mile segment, which Caltrain refers to as the south terminal area. This area is a key focus of the impact analysis concerning freight rail capacity.

Several public rail projects would add additional tracks to benefit planned passenger rail service increases. These tracks would also provide capacity usable by freight in the project extent between Caltrain's Centralized Equipment Maintenance and Operation Facility and I-280 south of San Jose Diridon Station. Table 3.2-23 shows the Caltrain South Terminal Project, which is the only planned rail capacity improvement project in the section through 2040.

Table 3.2-23 2040 Planned Rail Capacity Improvements

Project Name	Description
Caltrain South Terminal Project	The South Terminal Project is a multi-phased project to improve the South Terminal area of the Caltrain Corridor between Santa Clara and San Jose to accommodate potential future passenger rail traffic levels, including ACE, Capitol Corridor, and Amtrak. Phase 1 is already complete. Phase 2 includes construction of a fourth track and new signal controls between the south end of CEMOF and the north end of San Jose Diridon Station, as well as construction of a small section of track to install a crossover north of the CEMOF. Final design and environmental clearance has been completed for this phase of the project. Phase 3 consists of the construction of an additional track south of the South Terminal, between San Jose Diridon Station and the I-280 crossing. Phase 3 has been completed.

Source: Caltrain 2017
ACE = Altamont Corridor Express
CEMOF = Centralized Equipment Maintenance and Operation Facility
PCJPB = Peninsula Corridor Joint Powers Board

[25] The 2018 State Rail Plan freight forecasting estimates were used in this EIR/EIS for forecasting freight levels in the specified Northern California corridors only. Passenger rail volumes were based on estimates from passenger service rail planning, such as from the Peninsula Corridor Electrification Project for Caltrain.

Under 2040 No Project conditions, freight service levels are forecasted to increase compared to existing conditions. This additional freight service would benefit from the planned Caltrain improvements included in the Caltrain South Terminal Project. UPRR owns the MT-1 track in the Caltrain Corridor from CP Coast to CP Lick and the tracks southward from CP Lick to Gilroy. This track is sufficient to accommodate the potential increases in freight service shown in Table 3.2-22.[26] Caltrain service levels would increase with PCEP implementation between Santa Clara and Tamien, and ACE and Capitol Corridor may also increase service levels to San Jose (depending on funding, permitting, and UPRR consent) in the future, which would result in more train activity between Santa Clara and Tamien. Given UPRR's rights to control the use of MT-1, it can assure that there is adequate capacity for the potential freight increases, while Caltrain's South Terminal project would provide capacity for the other passenger rail services through additional track separate from MT-1. As such, under 2040 No Project conditions, adequate capacity would be available to support potential freight service increases.

Project Impacts

Construction Impacts

Impact TR#20: Temporary Impacts on Freight Rail Operations

The construction of the HSR stations, platforms, and track alignment would require building in certain areas currently used for freight service. Construction may require the temporary closure of tracks presently used by freight. Any closure or removal of freight track during construction would be temporary. Chapter 2, Alternatives, further describes the construction activities.

Freight rail operations occur in the rail rights-of-way that would be used for portions of the project construction, and as a result, project construction would disrupt freight rail operations. This would inconvenience freight operators and customers and could result in additional truck traffic if necessary to meet freight delivery requirements.

Project-related construction, staging, and traffic would contribute to temporary interference with freight rail operations. The construction of the HSR stations, platforms, and track alignment would require TCEs. The TCE may require the temporary closure of freight tracks. A summary of the key areas of disruption to freight rail systems is as follows, including estimated locations (from north to south) and estimated durations of disruption.

Per TR-IAMF#9, the project contractor will repair any structural damage to freight or public railways that may occur during the construction period and return any damaged sections to their original structural condition. If necessary, a shoofly track would be built to allow existing train lines to bypass any areas closed for construction activities where feasible. Upon completion, tracks would be opened and repaired or new mainline track would be built, and the temporary shoofly track would be removed. Shoofly tracks are only feasible in areas with unconstrained right-of-way with adequate space and may not be feasible in constrained areas. Where shoofly tracks are not feasible, there could be temporary delays on the order of hours or at most a few days, and the closures would usually occur at nights and on weekends and holidays to minimize disruption.

Alternative 2 would have the greatest potential to disrupt freight rail operations during construction, followed by Alternative 4, then Alternative 1, and finally Alternative 3 with the least potential.

Alternative 1 would disrupt freight rail operations at the following locations:

- **Entire route**—Alternative 1 would include some utility relocation work at discrete locations, but this is not expected to result in delay or closure of freight rail service.
- **San Jose Diridon Station Approach Subsection**—Alternative 1 would relocate MT-1 and other UPRR tracks from north of I-880 to Julian Street and would reconstruct or relocate the Lenzen Wye leading to the Union Pacific Warm Springs Subdivision. During connection of the existing tracks to the new tracks, there may be a shutdown of the existing track for several

[26] The nominal capacity of a single-track line for freight is 30 daily trains, as indicated in the Alameda County Transportation Commission Goods Movement Strategy (2016).

days (on weekends if feasible), which would affect freight service. At San Jose Diridon Station, construction of the aerial HSR station would close one platform (two tracks) at a time, so that the station would continue to operate, but during peak times there would be more congestion with the loss of two tracks and a platform. During closure of MT-1, freight would be rerouted to one of the open tracks around the closure. Alternative 1 would cross over the Caltrain Corridor just east of where it crosses SR 87. Crossovers have the potential for several-day closures (on weekends if feasible). South of West Alma Avenue to CP Lick, Alternative 1 would relocate the existing tracks eastward, which would affect freight service during the several-day closure during connection of the existing track and the new track. South of Almaden Expressway, the Luther Spur would be relocated.

- **Monterey Corridor Subsection**—Alternative 1 would cross over the UPRR right-of-way where it enters Monterey Highway near Fehren Drive, which has the potential for several-day closures (on weekends if feasible).
- **Morgan Hill and Gilroy Subsection**—At the Gilroy Station, the UPRR tracks would be relocated starting just north of the station to south of the station, which may result in several days of disruption to freight service. Alternative 1 would relocate a UPRR siding track south of US 101 and would build a roadway bridge over the UPRR Hollister Branch, both of which would result in several days of freight rail disruption.
- **Pacheco Pass Subsection**—There are no freight rail lines in this subsection.
- **San Joaquin Valley Subsection**—Alternative 1 would cross over the Westside Line and there may be several days of closure during construction.

Alternative 2 would include the following locations of potential disruption to freight rail operations:

- **Entire route**—Alternative 2 would include some utility relocation work at discrete locations, but this is not expected to result in delay or closure of freight rail service.
- **San Jose Diridon Station Approach Subsection**—Alternative 2 would relocate MT-1 and MT-2 from south of Scott Boulevard to CP Coast, relocate MT-1 and other freight tracks from CP Coast to just south of I-880, and rebuild or relocate the Lenzen Wye leading to the UP Warm Springs Subdivision. Connection of the existing tracks to the new tracks may shut down the existing track for 1 to 2 days (on weekends if feasible), which would affect freight service. At San Jose Diridon Station and south of the station, Alternative 2 would have the same impacts as Alternative 1.
- **Monterey Corridor Subsection**—Alternative 2 would cross over the UPRR right-of-way when it enters Monterey Highway near Fehren Drive, which would require a closure for 1 to 2 days (on weekends if feasible). Alternative 2 would include grade separations that cross the UPRR right-of-way at Skyway Drive, Branham Avenue, and Chynoweth Avenue, each of which would result in possible 1- to 2-day closures (on weekends if feasible). Alternative 2 would also include shoofly tracks at the Caltrain Capitol and Blossom Hill Stations. In south San Jose south of Menard Avenue from UPRR MP 58.1 to MP 59.4 at the PG&E Metcalf Station, approximately 1.3 miles of the UPRR tracks would be realigned. Freight service would be closed for several days during connection of the new tracks to the existing tracks.
- **Morgan Hill and Gilroy Subsection**—Alternative 2 would include grade separations that cross the UPRR right-of-way at 18 locations,[27] each of which would result in possible closures of 1 to 2 days (on weekends if feasible). Alternative 2 would include shoofly tracks at the Caltrain Morgan Hill, San Martin, and Gilroy Stations. Alternative 2 would require track relocation in the following areas: approximately 1.8 miles of tracks from south of Maple Avenue (near UPRR MP 69.5) to just south of San Martin Avenue (near MP 71.3);

[27] Palm Avenue, Live Oak Avenue, Madrone Parkway, East Dunne Avenue, Barrett Avenue, San Pedro Avenue, Tennant Avenue, East Middle Avenue, East San Martin Street, Oak Street, Church Avenue, Masten Avenue, Leavesley Road, IOOF Avenue, Lewis Street, 6th Street, Old Gilroy Street, and 10th Street.

approximately 1.5 miles of UPRR tracks from south of Cohansey Avenue (near MP 75.1) to IOOF Avenue (between MP 76.6 and 76.7); and approximately 1.4 miles from 6th Street (MP 77.1) to south of US 101 (approximately MP 78.5). Freight service would be closed for several days at each track realignment location during connection of the new tracks to the existing tracks. Alternative 2 would relocate a UPRR siding track south of US 101 and would include a roadway bridge over the UPRR Hollister Branch, both of which would result in several days of freight rail disruption.

- **Pacheco Pass Subsection**—There are no freight rail lines in this subsection.
- **San Joaquin Valley Subsection**—Alternative 3 would have the same impacts as Alternative 1.

Alternative 3 would include the following locations of potential disruption to freight rail operations:

- **Entire route**—Alternative 3 would include some utility relocation work at discrete locations, but this is not expected to result in delay or closure of freight rail service.
- **San Jose Diridon Station Approach Subsection**—Alternative 3 would have the same impacts as Alternative 2.
- **Monterey Corridor Subsection**—Alternative 3 would have the same impacts as Alternative 1.
- **Morgan Hill and Gilroy Subsection**—Alternative 3 would have no major disruptions to freight rail service.
- **Pacheco Pass Subsection**—There are no freight rail lines in this subsection.
- **San Joaquin Valley Subsection**—Alternative 3 would have the same impacts as Alternative 1.

Alternative 4 would include the following locations of potential disruption to freight rail operations:

- **Entire route**—Alternative 4 would include some utility relocation work at discrete locations, but this is not expected to result in delay or closure of freight rail service.
- **San Jose Diridon Station Approach Subsection**—North of San Jose Diridon Station (De La Cruz Blvd to Santa Clara Street), Alternative 4 would include a new dedicated freight track between CP Coast and CP Shark. From San Jose Diridon Station to CP Lick (Park Avenue to Daylight Way), Alternative 4 would convert the current double-track corridor which also carries freight and conventional passenger services to three tracks with single dedicated freight track for freight, ACE, Amtrak, and Capitol Corridor and two electrified tracks under cantilever OCS for HSR and Caltrain). This will maintain capacity for freight and all existing passenger services while providing additional capacity for planned Caltrain expansion with the Peninsula Corridor Electrification Project and the proposed HSR service. Existing spurs, siding connections, at-grade crossings, and grade separations would be retained. The Michael Yard would be reconfigured to retain storage capacity with additional connection to the storage tracks at the southern end. Rail bridges over Bird Avenue and Delmas Avenue would be modified to accommodate three tracks.
- **Monterey Corridor Subsection**—Between CP Lick and Coyote, Alternative 4 would convert the corridor to a single dedicated freight track and two electrified tracks under OCS. Alternative 4 would retain the existing spur or siding connections and avoid changing existing overcrossings. Alternative 4 would add 2,500 feet of new freight siding at CP Coyote (between Blanchard Road and Bailey Avenue).
- **Morgan Hill and Gilroy Subsection**—Alternative 4 would convert the corridor to a single dedicated freight track and two electrified tracks under OCS. Alternative 4 would retain the existing spur or siding connections and avoid changing existing overcrossings. Alternative 4 would replace the rail bridge across the Upper Llagas Creek floodway. Alternative 4 would reconfigure the Gilroy station to accommodate UPRR, HSR, Caltrain, Amtrak, and TAMC,

and would add a freight rail spur to supply the HSR maintenance facility. The HSR mainline and maintenance spur would be designed to minimize changes to the Hollister Subdivision and Watsonville lines. South of CP Luchessa, Alternative 4 would realign the Hollister branch line to the west, adjacent to the main line to Watsonville.

- **Pacheco Pass Subsection**—There are no freight rail lines in this subsection.
- **San Joaquin Valley Subsection**—Alternative 4 would have the same impacts as Alternative 1.

Railroad properties include the UPRR MT-1 track from CP Coast to CP Lick, the UPRR corridor south to Gilroy, the Hollister Subdivision and the Watsonville Line south of Gilroy, and the Westside line near Volta. Permission for temporary access onto railroad property would be necessary during construction. To avoid affecting railroad operations during construction, the contractor would be responsible for reaching an agreement on the timing and duration of activities prior to implementing a TCE on railroad property. Under all project alternatives, the design-build contractor would finalize specific TCEs during final project design in coordination with the affected railroads for those areas where access is required. In areas where TCEs would cross railroad property, the Authority would avoid affecting railroad operations to the extent possible.

Because construction conditions may vary, there is a possibility for disruption to or temporary delay of railroad operations. However, the Authority and the freight railroads would work together to construct the project in a manner consistent with the agreements negotiated by the Authority's contractor during the final design process. This would enable each entity to conduct its relevant activities in a manner that would reduce impacts on freight railroad operations. The Authority would coordinate with the freight railroads to prevent incompatible uses resulting from project construction.

During project construction, the contractor would minimize disruption of freight rail service with shoofly tracks, scheduling, and use of existing alternative tracks where available. There may be a temporary period of service disruption when connecting existing tracks to shoofly tracks. Where feasible, the contractor would schedule any necessary cessation of freight rail service during the weekend to minimize disruption. Service disruptions, when they occur, would last several hours to several days.

CEQA Conclusion

The impact under CEQA would be significant for all four project alternatives because project construction would substantially disrupt or interfere with freight operations in the San Jose Diridon Station Approach Subsection between CP Coast and San Jose Diridon Station. Alternatives 2 and 4 would also have substantial disruptions in the Monterey Corridor and Morgan Hill and Gilroy Subsections resulting in delays and rescheduling of freight service. This disruption could also result in the temporary diversion of freight to trucks, causing additional noise, air quality, GHG emissions, and roadway traffic compared to transport by rail. Mitigation Measures to address this impact are identified in Section 3.2.9, CEQA Significance Conclusions. Section 3.2.7, Mitigation Measures, describes these measures in detail.

Operations Impacts

Impact TR#21: Continuous Permanent Impacts on Freight Rail Capacity

This impact concerns the potential for project operations to limit freight service because of the sharing of tracks north of CP Coast with Alternatives 1 and 4.

Under Alternative 1, HSR would operate on dedicated tracks from I-880 to Merced and there would be no operations impacts on freight service on adjacent or crossing railroads. From CP Coast to I-880, HSR trains would operate on MT-2 and MT-3 while freight rail would use MT-1, and thus project operations in this area would have no impact on freight rail operations or access to the Newhall Yard. From Scott Boulevard to CP Coast, HSR and freight would share MT-1 and MT-2 with potential freight timing and capacity conflicts.

Under Alternatives 2 and 3, HSR would have dedicated tracks for the entire length of the project from Scott Boulevard to Carlucci Road in Merced County. These project alternatives would have no impact on freight operations or access to freight facilities such as Newhall Yard.

Under Alternative 4, HSR would have dedicated tracks from Gilroy to Carlucci Road in Merced County. From San Jose to Gilroy, Alternative 4 would operate on dedicated tracks for Caltrain and HSR, which would be separate from a third-track that would be used for freight and other passenger rail operations (Amtrak Starlight and the TAMC service to Salinas). Between San Jose and Gilroy, there would remain adequate separate rail line capacity for potential freight growth, as shown in Table 3.2-23. From San Jose Diridon to CP Coast, HSR would share track with Caltrain on MT-2 and MT-3, while freight would operate on MT-1; the project would have no impact on freight rail operations or access to the Newhall Yard. From Scott Boulevard to CP Coast, HSR and freight would both share MT-1 and MT-2, with potential freight timing and capacity conflicts.

For Alternatives 1 and 4, HSR, Caltrain, and freight would all operate on the same MT-1 and MT-2 tracks north of CP Coast to Scott Boulevard. North of Scott Boulevard, all alternatives would operate on the same MT-1 and MT-2 tracks. The Authority expects to operate up to four trains per hour per direction during peak hours between San Jose and San Francisco. During off-peak hours, the Authority expects to operate up to three trains per hour per direction between San Jose and San Francisco. HSR revenue service would be conducted between 6:00 a.m. and midnight.

Because of the amount and speed of both HSR and Caltrain operations and the need to maintain established service as scheduled, slow-moving and long freight trains would not be able to access the Caltrain corridor mainline tracks north of CP Coast during peak hours in the morning and peak hours in the evening. Freight operations would be able to operate outside peak hours including the midnight to 5 a.m. period.[28] Between midnight and 5 a.m., regular HSR service would not be operating, but some HSR trains would still use the Caltrain Corridor to reach maintenance facilities and start locations for the next day's service. The recently adopted FRA rules concerning the sharing of HSR with conventional freight and passenger services (FRA 2016) allow for the blending of HSR with heavier freight rail.

Because the ability to accommodate freight operations on the shared tracks north of CP Coast could affect freight operations both north and south of CP Coast, the potential effect of constrained work windows for existing freight service between Santa Clara and San Francisco was reviewed, as follows:

- The South City Switcher freight services: Since this freight service operates during off-peak hours and is of short duration, daytime operations of this service can be accommodated. Even with expected limited growth by 2040 (as described in Table 3.2-22), there is adequate time to maintain this as a daytime service between peak hours.
- Broadway Local/Mission Bay Hauler/Granite Rock freight services: Early evening access for these services may be difficult to provide due to conflict with passenger train congestion during the peak hours. Based on the average service durations, these services should be able to complete normal round-trip service in less than 4 hours most of the time, which could be accommodated either through later evening and night operations or, if necessary, between midnight and 5 a.m. outside of HSR and Caltrain operational times. Infrequently, freight operators may not be able to be complete round-trip service in a single night using a single train if the freight moves are particularly complex and take more time than current trains do. In these infrequent conditions, trips may need to be staggered over several nights, as is currently done on the South City Local between South San Francisco and San Francisco. Alternatively, freight operators could employ additional trains operating in each direction (one-way transit per night) or longer trains in order to maintain the same level of

[28] Freight service hours are not limited by the TRA on the UPRR-owned dedicated freight MT-1 track between CP Coast and CP Lick (Santa Clara to south of Tamien Station); operating hours would not be limited on this track.

service as a round trip that they could otherwise complete in a single night (see further discussion below).

- Based on the 2040 forecast in Table 3.2-22, the average number of freight trains between South San Francisco and San Francisco could rise from two to three, and the average number of freight trains between San Jose and South San Francisco could rise from four to seven in 2040. With the new train control system to be installed in the Caltrain Corridor, in concept the system would operate with headways (e.g., time between trains) of 3 minutes, which allow for up to 20 trains per hour per direction to be accommodated on the system during peak hours with passenger trains operating at similar speeds and with compatible stopping patterns. With a mixture of services with differing speed profiles (such as passenger trains and freight trains) or stopping patterns, the capacity will be lower. Sogin et al. (2013) evaluated freight track capacity assuming trains operating at 50 miles per hour with average train lengths of 6,300 feet (much longer than average trains used in the Caltrain Corridor) and identified that single-track freight lines are considered congested at 36 trains per day and double-track freight lines are considered congested at 64 trains per day. Between midnight and 5 a.m., while there will be some nonrevenue passenger trains on the Caltrain Corridor, the dedicated single track for freight will be maintained (as required in the TRA), so at least one track would function as a freight-dedicated line. Even though the Sogin et al. (2013) study was for tracks with much longer freight trains, if one divided the estimated single-track daily capacity of 36 freight trains (without congestion) to account for 5 hours (instead of 24 hours), the nominal freight capacity between midnight and 5 a.m. would be approximately seven to eight trains per night. Given the shorter trains used in the Caltrain Corridor, the capacity is expected to exceed this estimate. As described above, there are also expected to be some freight slots available at night prior to midnight following passenger rail peak hours. As such, blended Caltrain and HSR service is expected to accommodate baseline and forecasted freight volumes to 2040.

Although available work windows may be constrained somewhat compared to existing conditions, existing and forecasted 2040 freight levels can be accommodated in the areas north of CP Coast where HSR, Caltrain, and freight would share tracks because adequate durations of track access would be available to complete track moves to serve freight customers, based on review of data on freight operations in the corridor.

Infrequently, it is possible that freight operators may need to use longer trains or additional trains, or stagger deliveries over two nights in the limited situations when deliveries cannot be made in a single night due to somewhat more constrained nighttime work windows, as summarized below:

- A review of October 2019 freight dispatch data (PCJPB 2019) shows that the maximum train length used in practice is two to three times or more the average train consist length. This indicates that, in general, existing freight rail facilities used for the existing rail services can and do accommodate trains of greater than average length on occasion. There may be other constrained facilities beyond the mainline yard facilities that could constrain the use of longer trains to address more limited work windows.
- Additional trains would also be used for the limited situations when deliveries cannot be made in a single night due to somewhat more constrained nighttime work windows. As described above, there is additional capacity beyond current freight service levels, even if only accounting for the midnight to 5 a.m. period and use of only one track.
- A third option would be to stagger trains over two nights in limited situations when deliveries cannot be made in a single night due to somewhat more constrained nighttime work windows. Caltrain dispatch data shows that current freight rail service does use this strategy on occasion at present.

Adding additional trains or staggering trains are not expected to be strategies that freight operators would use on a routine basis because there is adequate capacity to accommodate both baseline and 2040 forecasted trains along the Caltrain Corridor. Thus, these strategies are expected to only be employed infrequently.

Consequently, the compression of freight service hours would not result in a diversion of freight hauling from freight trains to trucks or other modes and, thus, would not result in any potential secondary impacts related to air quality, GHG emissions, noise, or traffic congestion.

CEQA Conclusion

There would be no impact under CEQA for Alternatives 2 and 3. The impact under CEQA would be less than significant for Alternatives 1 and 4 because these alternatives would not cause a change in freight rail service such that resultant diversions to truck or other freight modes would occur. Freight operation hours would be constrained, which would inconvenience operators, but freight operations overall would be maintained. Diversion of freight from rail to other modes is not likely to occur with changes in freight operations hours with project operations. Thus, no significant secondary impacts related to air quality, noise, GHG emissions, or traffic operations are expected. Therefore, CEQA does not require mitigation.

Impact TR#22: Continuous Permanent Impacts on Freight Rail Operations

This impact concerns the potential for the project alternatives to affect height clearances for freight from the installation of the OCS over rail lined used by freight. This impact has the potential to occur under Alternatives 1 and 4, where OCS would be installed along tracks used by freight (but owned by Caltrain) from Scott Boulevard to CP Coast with the Caltrain Corridor.

Installation of the OCS would lower the existing vertical clearance at bridges and other crossings and structures over the Caltrain Corridor but not to a degree that would require a change in existing freight equipment used to service this corridor. The Caltrain PCEP EIR (PCJPB 2015) evaluated the overhead clearance necessary for an OCS along the Caltrain Corridor. Between Scott Boulevard and CP Coast, the highest freight equipment operating in recent past has been Plate H (20.25 feet). The OCS for HSR and Caltrain would provide clearance for freight vehicles up to 20.25 feet in height to maintain clearance for freight operations (clearance for a vehicle of a 20.25-foot height would be provided, the structure would be higher). Consequently, the project would not restrict freight vehicle height compared to existing conditions along the Caltrain Corridor for either Alternatives 1 or 4.

With Alternative 4, although OCS would be installed over tracks to be shared with Caltrain in blended operations between San Jose and Gilroy, the OCS would not be installed over the separate track for freight operations.

CEQA Conclusion

There would be no impact under CEQA for Alternatives 2 and 3 because freight service would not share tracks with HSR. The impact under CEQA would be less than significant for Alternatives 1 and 4 because the HSR OCS associated with these alternatives would not disrupt or interfere with freight operations and or require greater temporal separation. The OCS installed between Scott Boulevard and CP Coast would lower overhead height clearance at constrained locations, but the residual height clearance with the OCS would still be greater than the highest freight equipment using this portion of the Caltrain Corridor under existing conditions. Since the effective height allowance would not be altered compared to existing conditions, this alternative would not disrupt or interfere with freight operations and or require greater temporal separation and would not require a diversion of freight from rail to trucks (or other modes) and no secondary impacts related to air quality, noise, GHG emissions, or traffic operations would occur. Therefore, CEQA does not require mitigation.

3.2.7 Mitigation Measures

The transportation-specific mitigation measures shown in Table 3.2-24 are available to address impacts on traffic delay, transit service, and freight rail service.

The Authority has identified mitigation measure TR-MM#1 (and its sub-elements) that may address adverse traffic delay effects, which are only considered as NEPA effects and are not considered CEQA impacts. NEPA requires a reasonably complete discussion of mitigation measures for identified adverse effects. NEPA does not require that the Authority commit to potential mitigation measures. As discussed below, the Authority may, at its discretion, adopt or

decline to adopt mitigation measures to address traffic delay effects. Mitigation measures TR-MM#2 and TR-MM#3 are proposed to address significant CEQA impacts, based on CEQA's provisions related to adoption of feasible mitigation measures for significant CEQA impacts (unless there are overriding considerations).

Table 3.2-24 Transportation-Specific Mitigation Measures

Mitigation Measure	Community	Alternative 1	Alternative 2	Alternative 3	Alternative 4
TR-MM#1: Potential Mitigation Measures Available to Address Traffic Delays (NEPA Effect Only)	Multiple (See below)	X	X	X	X
TR-MM#1a: Monterey Road Construction Modifications	South San Jose	X	X	X	
TR-MM#1b: The Alameda (SR 82)/Taylor Street–Naglee Avenue—Restripe Northbound Approach	San Jose Diridon	X	X	X	
TR-MM#1c: Optimize Signal Coordination on West Santa Clara Street from Stockton Street to Autumn Street in San Jose	San Jose Diridon	X	X	X	X
TR-MM#1d: Monterey Road/Capitol Expressway Eastbound Ramps—Widen and Reconfigure	South San Jose	X	X	X	
TR-MM#1e: Monterey Road/Chynoweth Avenue–Roeder Road—Widen and Reconfigure	South San Jose	X	X	X	X
TR-MM#1f: Monterey Road/Senter Road—Widen and Reconfigure Southbound Approach	South San Jose	X	X	X	
TR-MM#1g: Monterey Road/Senter Road—Widen and Reconfigure Westbound Approach	South San Jose	X	X	X	
TR-MM#1h: Monterey Road/Blossom Hill Westbound Ramps—Reconfigure Northbound Approach	South San Jose	X	X	X	
TR-MM#1i: Monterey Road/Blossom Hill Road Eastbound Ramps—Widen and Reconfigure	South San Jose	X	X	X	
TR-MM#1j: Senter Road/Hellyer Avenue—Restripe Westbound Approach	South San Jose	X	X	X	
TR-MM#1k: Houndshaven Way/Skyway Drive—Widen and Reconfigure	South San Jose	X	X	X	
TR-MM#1l: Vistapark/Branham Lane—Reconfigure Southbound Approach	South San Jose	X	X	X	

Mitigation Measure	Community	Alternative 1	Alternative 2	Alternative 3	Alternative 4
TR-MM#1m: Lean Avenue/Blossom Hill Road—Improve Signal Phasing	South San Jose	X	X	X	
TR-MM#1n: Cottle Road/Poughkeepsie Road—Restripe Eastbound Approach	South San Jose	X	X	X	
TR-MM#1o: Santa Teresa Boulevard/Bernal Road—Restripe Westbound Approach	South San Jose	X	X	X	
TR-MM#1p: Santa Teresa Boulevard/Bailey Avenue—Reconfigure	South San Jose	X	X	X	
TR-MM#1q: Monterey Road/Tilton Avenue—Various Improvements	Morgan Hill	X		X	X
TR-MM#1r: Hale Avenue/Madrone Parkway—Signal at New Connection	Morgan Hill		X		
TR-MM#1s: Monterey Road/Madrone Parkway—Widen and Reconfigure	Morgan Hill		X		
TR-MM#1t: Monterey Road/San Martin Avenue—Restripe Southbound Approach	San Martin				X
TR-MM#1u: Monterey Road/IOOF Avenue—Widen and Reconfigure Southbound Approach	Gilroy				X
TR-MM#1v: Coordinate Signal Timings on 10th Street from Chestnut Street to Monterey Road in Gilroy	Gilroy	X	X		
TR-MM#1w: Chestnut Street/Luchessa Street—Reconfigure Southbound Approach	Gilroy				X
TR-MM#1x.1: Cahill Street/Stover-Crandall Street—Install Traffic Signal	San Jose Diridon	X	X	X	X
TR-MM#1x.2: Montgomery Street/Stover-Crandall Street—Install Traffic Signal	San Jose Diridon				X
TR-MM#1x.3: Cahill Street/West San Fernando Street—Install Traffic Signal	San Jose Diridon	X	X	X	X
TR-MM#1x.4: Houndshaven Way/Skyway Drive—Install Traffic Signal	South San Jose	X	X	X	
TR-MM#1x.5: Hale Avenue/Tilton Avenue—Install Traffic Signal	Morgan Hill	X	X	X	
TR-MM#1x.6: East Main Avenue/Depot Street—Install Traffic Signal	Morgan Hill				X

Mitigation Measure	Community	Alternative 1	Alternative 2	Alternative 3	Alternative 4
TR-MM#1x.7: Railroad Avenue/Tennant Avenue—Install Traffic Signal	Morgan Hill		X		
TR-MM#1x.8: Llagas Road/San Martin Avenue—Install Traffic Signal	San Martin		X		
TR-MM#1x.9: School Access/IOOF Avenue—Install Traffic Signal	Gilroy				X
TR-MM#1x.10: SR 25/Bloomfield—Install Traffic Signal	Gilroy	X	X	X	X
TR-MM#2: Install Transit Signal Priority	Various	X	X	X	X
TR-MM#3: Railway Disruption Control Plan	Various	X	X	X	X

NEPA = National Environmental Policy Act
SR = State Route

3.2.7.1 Traffic Delay Mitigation

The following mitigation is available to address adverse traffic delay effects of the project alternatives.

TR-MM#1: Potential Mitigation Measures Available to Address Traffic Delays (NEPA effect only)

On February 5, 2021, the Authority finalized "Decision-making Guidance for the Adoption of Traffic Mitigation Measures" (Authority 2021a). This memorandum describes SB 743 and its effect on CEQA transportation analysis, describes NEPA requirements concerning the analysis of traffic effects and consideration of traffic mitigation, and provides criteria for screening and selection of traffic mitigation. Five screening criteria were identified to ensure traffic mitigation measures:

- Do not cause an increase in VMT;
- Would not contradict the objectives of SB 743;
- Are not more disruptive to the community than the impact itself;
- Do not result in unmitigable secondary environmental effects; and
- Are determined by the Authority to be practicable (including consideration of cost).

A range of potential traffic mitigation measures were evaluated using these criteria. The traffic mitigation measures considered and the evaluation as to which measures met or did not meet these criteria are presented in Volume 2, Appendix 3.2-C. The Authority is only describing in this section the traffic mitigation measures that met the criteria (these are the mitigations included below).

Congested freeway operations can be addressed by freeway widening and the construction of express lanes by other agencies, as identified in the MTC RTP (MTC 2013). The Authority is not proposing freeway widening or construction of express lanes as specific mitigation for project congestion/delay effects, for the reasons discussed in Volume 2, Appendix 3.2-C.

Mitigation measures to address permanent congestion/LOS effects on intersection operations from permanent road closures and relocations (all alternatives), increased gate-down time at the at-grade crossings (Alternative 4 only), and vehicle flow to/from HSR stations (all alternatives) could include one or more combinations of various standard intersection capacity enhancements, such as signal retiming or additions, lane restriping, road/intersection widening and turn pocket

additions/increases. Those mitigation measures that passed the screening evaluation in Volume 2, Appendix 3.2-C are described below.

The following site-specific mitigation measures to address adverse traffic delay/congestion effects are proposed.

TR-MM #1a: Monterey Road Construction Modifications

This measure applies to Alternatives 1, 2, and 3.

Prior to and during construction, the contractor will install and provide the following improvements:

- Pre-time and coordinate all signals on Monterey Road from Capitol Expressway to Blossom Hill Road.
- Monterey Road at Capitol Expressway Westbound Ramps—Maintain channelized westbound right turn and northbound right turn.
- Monterey Road at Senter Road—Maintain channelized westbound right turn and northbound right turn.
- Monterey Road at Skyway Drive—Maintain southbound right turn and northbound right turn pockets. Restripe eastbound approach to one shared through/right lane and one left turn lane.
- Monterey Road at Branham Lane—Maintain channelized southbound right turn and eastbound right turn.
- Monterey Road at Chynoweth Avenue—Maintain channelized southbound right turn and westbound right turn. Restripe eastbound approach to one shared through/right lane and one left turn lane.
- Monterey Road at Blossom Hill Road Eastbound Ramps—Maintain channelized northbound right turn.
- Monterey Road at Fehren Drive—Maintain westbound channelized right turn.
- Santa Teresa Boulevard at Bernal Road—Restripe one westbound through lane to left turn lane.

This mitigation measure will improve operations at these intersections by optimizing road geometry, thereby reducing the project's impacts, but it will not eliminate all impacts during construction along the Monterey Corridor. Implementing TR-MM#1a would not result in secondary impacts, because the improvements will occur entirely in the existing rights-of-way and the project footprint of the project alternatives.

TR-MM#1b: The Alameda (SR 82)/Taylor Street–Naglee Avenue—Restripe Northbound Approach

This measure applies to Alternatives 1, 2, and 3.

Prior to HSR operations, the contractor will modify the northbound approach at The Alameda (SR 82)/Taylor Street–Naglee Avenue intersection. This approach will be reconfigured to provide a left turn lane, two through lanes, and an exclusive right turn lane. This restriping will necessitate the removal of curb on-street parking for the block between West Taylor Street and Naglee Avenue. The contractor will prepare all materials necessary to obtain the approval of the City of San Jose and Caltrans for the implementation of the modification.

This mitigation measure will be effective in improving the operation at this intersection by providing additional vehicle capacity, thereby mitigating the project's impacts. Implementing TR-MM#1b would remove curb on-street parking for the block between West Taylor Street and Naglee Avenue on the east side of The Alameda but would not otherwise result in secondary

effects. The removal of parking on this block may be inconvenient but is not expected to result in significant secondary physical impacts on the environment.

TR-MM#1c: Optimize Signal Coordination on West Santa Clara Street from Stockton Street to Autumn Street in San Jose

This measure applies to all alternatives.

Prior to HSR operations, the contractor will modify the signal and optimize the signal timings and coordination for the traffic signals on West Santa Clara Street from Stockton Street to Autumn Street. This improvement includes the intersections of West Santa Clara Street with Stockton Street, Cahill Street, Montgomery Street, and Autumn Street. The contractor will prepare all materials necessary for the approval of the City of San Jose for the implementation of the modification.

This mitigation measure will improve operations at these intersections by optimizing the effectiveness of the existing traffic signal systems, which will provide additional vehicle carrying capacity. This measure will fully mitigate project effects at the West Santa Clara Street intersections with Stockton Street, Montgomery Street, and Cahill Street for Alternatives 1, 2, and 3, but the project's impacts will still be adverse at the West Santa Clara Street intersections with Stockton Street and Cahill Street for Alternative 4 and Autumn Street for all alternatives. Implementing TR-MM#1c would not result in secondary impacts, because all work will be accomplished in the existing roadway right-of-way.

TR-MM#1d: Monterey Road/Capitol Expressway Eastbound Ramps—Widen and Reconfigure

This measure applies to Alternatives 1, 2, and 3.

Prior to HSR operations, the contractor will widen and reconfigure the Monterey Road/Capitol Expressway eastbound ramps intersection. The specific improvements include lengthening the southbound left turn pocket on Monterey Road and constructing a second westbound right turn lane. This improvement will be accommodated within the existing roadway right-of-way and would therefore not result in secondary impacts. The contractor will prepare all materials necessary for the approval of the City of San Jose for the implementation of these modifications.

TR-MM#1e: Monterey Road/Chynoweth Avenue–Roeder Road—Widen and Reconfigure

This measure applies to all alternatives.

Prior to HSR operations, the contractor will widen and reconfigure the Monterey Road/Chynoweth Avenue–Roeder Road intersection. The specific improvements include widening the northbound Monterey Road approach to add an additional left turn pocket and a right turn pocket, modify the eastbound Chynoweth Avenue approach to provide one shared through-right and one left turn only lane and widen the westbound Roeder Road approach to provide for an additional left turn pocket. This will require acquisition of additional right-of-way from the northeast and southeast corners of the intersection and would therefore result in secondary impacts. These parcels are currently occupied by gas pumps associated with two gas stations. The acquisition will result in displacement of some of the gas pumps, but the pumps could be relocated on the same property, and the business is not likely to be completely displaced. As a result, while there would be some secondary effects, with standard relocation assistance, unmitigable secondary effects would not result. This mitigation will reduce the adverse effect for Alternatives 1, 2, and 3, but effects will remain adverse for Alternative 4.

TR-MM#1f: Monterey Road/Senter Road—Widen and Reconfigure Southbound Approach

This measure applies to Alternatives 1, 2, and 3.

Prior to HSR operations, the contractor will widen the southbound Monterey Road approach to the Senter Road intersection to add an additional southbound left turn pocket. This improvement will require modification to the project design in the median of Monterey Road. The contractor will

prepare all materials necessary for the approval of the City of San Jose for the implementation of the modification.

This mitigation measure will be effective in improving the operation at this intersection by providing additional vehicle capacity, thereby mitigating the project's impacts. Implementing TR-MM#1f would result in secondary impacts because the widening of Monterey Road will involve the acquisition of right-of-way from the northeast corner of the intersection, which is occupied by a gas station. The acquisition will result in displacement of some of the gas pumps, but the pumps could be relocated on the same property, and the business is not likely to be completely displaced. As a result, while there would be some secondary effects, with standard relocation assistance, unmitigable secondary effects would not result.

TR-MM#1g: Monterey Road/Senter Road—Widen and Reconfigure Westbound Approach

This measure applies to Alternatives 1, 2, and 3.

Prior to HSR operations, the contractor will widen the westbound Senter Road approach to the Monterey Road intersection to add an additional westbound right turn pocket. The contractor will prepare all materials necessary for the approval of the City of San Jose for the implementation of the modification.

This mitigation measure will be effective in improving the operation at this intersection by providing additional vehicle capacity, thereby mitigating the project's impacts. Implementing TR-MM#1g would result in secondary impacts, because it would require the acquisition of additional right-of-way in the northeast corner of the intersection, which is currently occupied by a gas station. The acquisition would result in displacement of some of the gas pumps, but the pumps could be relocated on the same property, and the business is not likely to be completely displaced. As a result, while there would be some secondary effects, with standard relocation assistance, unmitigable secondary effects would not result.

TR-MM#1h: Monterey Road/Blossom Hill Westbound Ramps—Reconfigure Northbound Approach

This measure applies to Alternatives 1, 2, and 3.

Prior to HSR operations, the contractor will modify/widen the northbound Monterey Road approach to the Blossom Hill Road westbound ramps intersection to provide an exclusive right turn lane. While a northbound right turn lane currently exists at this location, the project will remove it as part of its implementation. The improvement will also necessitate modifications and improvements to the traffic signal at the Monterey Road/Blossom Hill Road westbound ramps intersection. The contractor will prepare all materials necessary for the approval of the City of San Jose for the implementation of the modification.

This mitigation measure will be effective in improving the operation at this intersection by providing additional intersection capacity and will also improve operations at the US 101 northbound and southbound ramps at Blossom Hill Road. This measure will mitigate the adverse effects of Alternatives 1, 2, and 3 at the US 101 northbound ramps at Blossom Hill Road and the adverse effects of Alternative 2 at the US 101 southbound ramps at Blossom Hill Road. While this measure will also reduce Alternatives 1 and 3 effects at the US 101 southbound ramps at Blossom Hill Road, it will not avoid an adverse effect in the AM peak period for these alternatives. While this measure will also reduce Alternative 2 effects at the Monterey Road/Blossom Hill westbound ramps, it will not avoid an adverse effect in the AM peak period for this alternative. Implementing TR-MM#1h would not result in secondary impacts, because all improvements will be accomplished in the existing rights-of-way.

TR-MM#1i: Monterey Road/Blossom Hill Eastbound Ramps—Widen and Reconfigure

This measure applies to Alternatives 1, 2, and 3.

Prior to HSR operations, the contractor will implement the following actions, depending on alternative:

- Widen and reconfigure the Monterey Road/Blossom Hill Road eastbound ramps intersection (mitigation for Alternatives 1 and 3). The specific improvements include prohibiting U-turns on the southbound Monterey Road approach and widening the westbound approach to add a right turn lane. Secondary effects would include the acquisition of additional right-of-way from the northeast corner of the intersection, which includes landscaped areas inside the ramps.
- Widen and reconfigure the Monterey Road/Blossom Hill Road eastbound ramps intersection (mitigation for Alternative 2). The specific improvements include widening the westbound approach to add a right turn lane and widening the southbound approach to add a left turn pocket. Secondary effects would include the acquisition of additional right-of-way from the northeast corner of the intersection, which includes landscaped areas inside the ramps.

TR-MM#1j: Senter Road/Hellyer Avenue—Restripe Westbound Approach

This measure applies to Alternatives 1, 2, and 3.

Prior to HSR operations, the contractor will stripe the westbound Hellyer Avenue approach to the Senter Road intersection to add an additional westbound left turn pocket and one shared-through right lane. This modification will also involve changes to the intersection's signal phasing, from the current east-west lead left phasing to an east-west lead-lag phasing. The contractor will prepare all materials necessary for the approval of the City of San Jose for the implementation of the modification. No secondary effects are expected, because all work will be accomplished in the existing roadway right-of-way.

TR-MM#1k: Houndshaven Way/Skyway Drive—Widen and Reconfigure

This measure applies to Alternatives 1, 2, and 3.

Prior to HSR operations, the contractor will widen and reconfigure the Houndshaven Way/Skyway Drive intersection. The specific improvements include widening the eastbound Skyway Drive approach to provide two left turn pockets and a shared through-right turn lane and widening the westbound approach to provide one right turn pocket, one through lane, and one left turn pocket. This will require acquisition of additional right-of-way from the parcel east of Monterey Road, which is already being acquired as part of the project and thus no additional displacement or secondary effects would occur due to this mitigation. These improvements at Houndshaven Way/Skyway Drive will eliminate the adverse effect for Alternative 2 but will not eliminate the adverse effect for Alternatives 1 and 3.

TR MM #1l: Vistapark Drive/Branham Lane—Reconfigure Southbound Approach

This measure applies to Alternatives 1, 2, and 3.

Prior to HSR operations, the contractor will reconfigure the southbound Vistapark Drive approach to the Branham Lane intersection to add an additional southbound left turn pocket. This improvement will require modifications to the existing median, intersection restriping, and modifications to the traffic signal. The mitigation will be accomplished within the existing right-of-way. The contractor will prepare all materials necessary for the approval of the City of San Jose for the implementation of the modification.

This mitigation measure will be effective in improving the operation at this intersection by providing additional vehicle capacity, thereby mitigating the project's impacts. Implementing TR-MM#1l would not result in secondary impacts.

TR MM#1m: Lean Avenue/Blossom Hill Road—Improve Signal Phasing

This measure applies to Alternatives 1, 2, and 3.

Prior to HSR operations, the contractor will modify the traffic signal phasing on the northbound and southbound approaches to Blossom Hill Road at Lean Avenue to replace the existing split phasing with protected left turn phasing. This improvement will require modifications to the traffic

signal equipment. The mitigation will be accomplished within the existing right-of-way. The contractor will prepare all materials necessary for the approval of the City of San Jose for the implementation of the modification.

This mitigation measure will be effective in improving the operation at this intersection by providing additional vehicle capacity, thereby mitigating the project's impacts. Implementing TR-MM#1m would not result in secondary impacts.

TR MM#1n: Cottle Road/Poughkeepsie Road – Restripe Eastbound Approach

This measure applies to Alternatives 1, 2, and 3.

Prior to HSR operations, the contractor will restripe the intersection's eastbound Poughkeepsie Road approach to the Cottle Road intersection to provide an exclusive right turn lane. This will be accomplished by modifying the existing shared through-right turn lane to be an exclusive right turn lane. The mitigation will be accomplished within the existing right-of-way. The contractor will prepare all materials necessary for the approval of the City of San Jose for the implementation of the modification.

This mitigation measure will be effective in improving the operation at this intersection by providing additional vehicle capacity, thereby mitigating the project's impacts. Implementing TR-MM#1n would not result in secondary impacts.

TR-MM#1o: Santa Teresa Boulevard/Bernal Road—Restripe Westbound Approach

This measure applies to Alternatives 1, 2, and 3.

Prior to HSR operations, the contractor will restripe the westbound approach at the Santa Teresa Boulevard/Bernal Road intersection. Specifically, the contractor will modify the westbound Bernal Road approach to convert a through lane to a left turn lane. This modification will also involve changes to the intersection's signal phasing, from the current east-west lead left phasing to an east-west lead-lag phasing. The contractor will prepare all materials necessary for and seek the approval of the City of San Jose for the implementation of the modification.

This mitigation measure will be effective in improving the operation at these intersections by providing additional vehicle capacity, thereby mitigating the project's impacts. Implementing TR-MM#1o would not result in secondary impacts because all work will be accomplished in the existing roadway right-of-way.

TR-MM#1p: Santa Teresa Boulevard/Bailey Avenue—Reconfigure

This measure applies to Alternatives 1, 2, and 3.

Prior to HSR operations, the contractor will reconfigure the Santa Teresa Boulevard/Bailey Avenue intersection. The specific improvements include the removal of the northbound and southbound channelized right turn pockets and their conversion to shared through-right lanes. While this improvement could be accomplished entirely in the existing right-of-way, it will require modifications to the existing traffic signal system at the intersection. The contractor will prepare all materials necessary for the approval of the City of San Jose for the implementation of these modifications. Implementing TR-MM#1p would not result in secondary impacts because all work will be accomplished in the existing roadway right-of-way.

TR-MM#1q: Monterey Road/Tilton Avenue—Various Improvements

This measure applies to Alternatives 1, 3, and 4.

This measure will include widening and reconfiguring the Monterey Road/Tilton Avenue intersection as follows (depending on alternative):

- The mitigation for Alternatives 1 and 3 is the addition of a second eastbound right turn lane. This mitigation would result in secondary impacts because it will require the elimination of on-street parking on the north side of Tilton Avenue approaching the intersection and narrowing of the landscaping on the residential property south side of the roadway but will not require

displacement of any residences. Modifications to the traffic and rail signal systems at the intersection will also be necessary. However, the removal of parking on the approach and the narrowing of landscaping would not result in significant secondary effects related to transportation, aesthetics or any other subject area.

- The mitigation for Alternative 4 is the interconnection of the Monterey Road/Tilton Avenue intersection with the Monterey Road/Burnett Avenue intersection, which will be accomplished within the roadway right-of-way and would not result in secondary impacts.

TR-MM#1r: Hale Avenue/Madrone Parkway—Signal at New Connection

This measure applies to Alternative 2.

Alternative 2 will alter the roadways and connections for Monterey Road/Tilton Avenue, and this intersection will be replaced by a new connection at Hale Avenue/Madrone Parkway. The specific improvement as mitigation for Alternative 2 is the installation of a traffic signal at the new Hale Avenue/Madrone Parkway intersection. This measure will be accomplished within the new roadway right-of-way constructed by the project and thus would have no additional secondary effects beyond the project construction effect.

TR-MM#1s: Monterey Road/Madrone Parkway—Widen and Reconfigure

This measure applies to Alternative 2.

Prior to HSR operations, the contractor will widen and reconfigure the Monterey Road/Madrone Parkway intersection. The specific improvements include reconfiguring the eastbound approach to include two right turn lanes and two left turn lanes and widening of the southbound approach to include a second southbound left turn lane. This mitigation will require a modification to the Alternative 2 roadway design modifications at this location and will be accommodated within the Alternative 2 footprint and right-of-way, and thus would have no additional secondary effects beyond the project construction effect.

TR MM #1t: Monterey Road/San Martin Avenue—Restripe Southbound Approach

This measure applies to Alternative 4.

Prior to HSR operations, the contractor will restripe the southbound Monterey Road approach to San Martin Avenue to provide additional capacity for the southbound left turn lane. This improvement will require the removal of the adjacent northbound left turn lane on Monterey Road into Burbank Avenue. This improvement will not require right-of way acquisition and thus would not result in secondary effects. The contractor will prepare all materials necessary for the approval of Santa Clara County for the implementation of the modification.

This mitigation measure will improve the operation at this intersection by providing additional vehicle capacity but will not avoid an adverse effect. Implementing TR-MM#1t would result in reduced vehicle capacity at an adjacent intersection (Monterey Road/Burbank Avenue).

TR MM #1u: Monterey Road/IOOF Avenue—Widen and Reconfigure Southbound Approach

This measure applies to Alternative 4.

Prior to HSR operations, the contractor will widen the southbound approach of Monterey Road to IOOF Avenue to provide an additional southbound left turn pocket.

This mitigation measure will be effective in improving the operation at this intersection by providing additional vehicle capacity, thereby mitigating the project's impacts. Implementing TR-MM#1u would result in secondary impacts consisting of the removal of parking on the west side of Monterey Road; however, the removal of parking on the approach is not considered to result in significant secondary effects on the environment.

TR-MM#1v: Coordinate Signal Timings on 10th Street from Chestnut Street to Monterey Road in Gilroy

This measure applies to Alternatives 1 and 2.

Prior to HSR operations, the contractor will furnish and install signal interconnect equipment and coordinate all signals on 10th Street from Monterey Road to Chestnut Street. This improvement includes the intersections of 10th Street with Chestnut Street, Alexander Street, and Monterey Road. The contractor will prepare all materials necessary for the approval of the City of Gilroy for the implementation of the modification.

This mitigation measure will be effective in improving the operation at these intersections by optimizing the existing traffic signal systems. This will provide additional vehicle carrying capacity, thereby mitigating the project's impacts. Implementing TR-MM#1v would not result in secondary impacts, because all work will be accomplished in the existing roadway right-of-way.

TR MM #1w: Chestnut Street/Luchessa Street—Reconfigure Southbound Approach

This measure applies to Alternative 4.

Prior to operations, the contractor will restripe the southbound approach of Chestnut Street to Luchessa Street to provide a southbound right turn pocket. This improvement will not require right-of-way acquisition.

This mitigation measure will be effective in improving the operation at this intersection by providing additional vehicle capacity, thereby mitigating the project's impacts. Implementing TR-MM#1 would not result in secondary impacts because all improvements will be within the existing roadway right-of-way.

TR-MM#1x: Install Traffic Signals at Various Locations

This measure applies to the specific alternatives noted below.

Prior to HSR operations, the contractor will install traffic signals at the following locations:

- TR-MM#1x.1: Cahill Street/Stover-Crandall Street (all alternatives)
- TR-MM#1x.2: Montgomery Street/Stover-Crandall Street (Alternative 4)
- TR-MM#1x.3: Cahill Street/West San Fernando Street (all alternatives)
- TR-MM#1x.4: Houndshaven Way/Skyway Drive (Alternatives 1, 2, and 3)
- TR-MM#1x.5: Hale Avenue/Tilton Avenue (Alternatives 1, 2, and 3)
- TR-MM#1x.6: East Main Avenue/Depot Street (Alternative 4)
- TR-MM#1x.7: Railroad Avenue/Tennant Avenue (Alternative 2)
- TR-MM#1x.8: Llagas Road/San Martin Avenue (Alternative 2)
- TR-MM#1x.9: School Access/IOOF Avenue (Alternative 4)
- TR-MM#1x.10: SR 25/Bloomfield (all alternatives).

The contractor will prepare all materials necessary for the approval of the City of San Jose, the City of Morgan Hill, the City of Gilroy, and Caltrans (as applicable) for the implementation of this improvement. For signalization in the City of Morgan Hill, the Authority will coordinate with the City of Morgan Hill for the extent of signal interconnections when the signal design advances, and for TR-MM#1x.7 the Authority will work with the City of Morgan Hill to maintain access to nearby properties.

This mitigation measure will be effective in improving the operation at these intersections by providing additional vehicle capacity, thereby mitigating the project's impacts. Implementing TR-MM#1x would not result in secondary impacts, because the improvements will occur entirely in the existing rights-of-way.

Table 3.2-25 summarizes intersection impacts after implementation of all the elements of mitigation measure TR-MM#1.

Table 3.2-25 Intersections with Adverse Effects after Mitigation

Intersection		Alternative 1	Alternative 2	Alternative 3	Alternative 4
San Jose Diridon Station Approach Subsection					
D12	Stockton Avenue/The Alameda-West Santa Clara Street (SR 82)				X
D13	Cahill Street/West Santa Clara Street (SR 82)				X
D15	Autumn Street (SR 82)/West Santa Clara Street (SR 82)	X	X	X	X
D24	Montgomery Street (SR 82)/West San Fernando Street				X
D25	Autumn Street (SR 82)/West San Fernando Street	X	X	X	
D27	Montgomery Street (SR 82)/Park Avenue	X	X	X	
D31	Montgomery Street-Bird Avenue (SR 82)/West San Carlos Street (SR 82)	X	X	X	
D33	Bird Avenue/Auzerais Avenue				X
D35	Bird Avenue/I-280 NB ramps	X	X	X	
D36	Bird Avenue/I-280 SB ramps	X	X	X	X
D37	Bird Avenue/West Virginia Street	X	X	X	X
D41	Coleman Avenue/Hedding Street	X	X	X	
D42	Coleman Avenue/Taylor Street	X	X	X	
D43	Delmas Avenue/West Santa Clara Street	X	X	X	
D48	Sunol Street/Auzerais Avenue				X
Monterey Corridor Subsection					
M1	Monterey Road/Capitol Expressway WB ramps	X	X	X	
M4	Monterey Road/Skyway Drive	X	X	X	X
M5	Houndshaven Way/Skyway Drive	X		X	
M6	Monterey Road/Branham Lane	X	X	X	X
M7	Houndshaven Way/Branham Lane	X	X	X	
M9	Monterey Road/Chynoweth Avenue-Roeder Road				X
M10	Roeder Road/Azucar Avenue-Vera Lane	X		X	X
M11	Monterey Road/Blossom Hill Road WB ramps (SR 82)		X		

Intersection		Alternative 1	Alternative 2	Alternative 3	Alternative 4
M22	Monterey Road/Edenview Drive	X	X	X	
M23	US 101 SB ramps/Blossom Hill Road	X		X	
M25	Bernal Road Overpass/Monterey Road ramp		X		
M28	Senter Road/Capitol Expressway	X	X	X	
M33	Snell Avenue/Branham Lane	X	X	X	
M36	Snell Avenue/Blossom Hill Road	X	X	X	
M45	Monterey Road/Fehren Drive	X	X	X	
M50	Saddlebrook Drive/Branham Lane				X
Morgan Hill and Gilroy Subsection					
MH6	Monterey Road/San Martin Avenue				X
MH7	Depot Road/San Martin Avenue				X
MH10	Monterey Road/E. Main Ave				X
MH26	Monterey Road/Masten Avenue				X
G1	Monterey Road/Buena Vista Avenue		X		
G15	Monterey Road (SR 152)/Welburn Avenue-Leavesley Road (SR 152)				X
G29	Monterey Road/Sixth Street				X
G33	Monterey Road/Seventh Street				X
G35	Monterey Road/Eighth Street				X
G46	Monterey Road/Las Animas Avenue		X		
G58	Alexander Street/Sixth Street				X

E. = east
I- = Interstate
NB = northbound
SB = southbound
SR = State Route
US = U.S. Highway
WB = westbound

3.2.7.2 Other Transportation Mitigation

The following mitigation is available to address other transportation effects not related to onroad traffic delays.

TR-MM#2: Install Transit Signal Priority

Prior to construction, the contractor will install bus transit signal priority at all traffic signals in the following locations:

- San Jose Diridon Station Area (all alternatives)
  - Cahill Street between West Santa Clara Street and Park Avenue
  - Montgomery Street between West Santa Clara Street and Park Avenue
  - Autumn Street between West Santa Clara Street and Park Avenue
- Monterey Road from Capitol Expressway and Blossom Hill Road (Alternatives 1, 2, and 3 only)
- Gilroy Station Area (Alternatives 1, 2, and 4)

Prior to operations, the contractor will install bus transit signal priority at all traffic signals in the following locations:

- San Jose Diridon Station Area
  - Cahill Street between West Santa Clara Street and Park Avenue
  - Montgomery Street between West Santa Clara Street and Park Avenue
  - Autumn Street between West Santa Clara Street and Park Avenue
- Monterey Road from Capitol Expressway and Blossom Hill Road
- Gilroy Station Area (Alternatives 1, 2, and 4 only)
- Monterey Road between 7th Street and 10th Street (Alternatives 1, 2, and 4 only)
- Alexander Street between 7th Street and 10th Street (Alternatives 1, 2, and 4 only)

This mitigation measure will be effective in improving the speed and reliability of bus routes affected by project-related trips by identifying targeted improvements to enhance operations. Implementing TR-MM#2 would not result in secondary impacts because operations improvements will be targeted and coordinated with local authorities to benefit users of bus transit services, while not adversely affecting other modes of travel.

TR-MM#3: Railway Disruption Control Plan

Prior to construction, the contractor will prepare a railway disruption control plan for Authority approval. During construction, the contractor will implement the plan. The goal of the railway disruption control plan will be to minimize the overall duration of disruption of passenger and freight operations and maintain reasonable LOS, while allowing for an expeditious completion of construction. The construction contractor will coordinate with passenger rail providers (Caltrain, ACE, Capitol Corridor, TAMC, and Amtrak) and with UPRR in advance and during any potential disruption to passenger or freight operations or passenger or UPRR facilities. The construction contractor will maintain passenger rail and UPRR's emergency access throughout construction.

The Authority will require the construction contractor, in cooperation with Caltrain, to implement the following coordination and consultation requirements:

- The contractor will establish a freight stakeholder committee to provide an information and feedback forum prior to and during construction with a minimum of quarterly coordination meetings during construction, which will include representatives from the Authority, Caltrain, UPRR, and freight operators and shippers.
- The contractor will consult with Caltrain, UPRR, and freight operators and shippers during preparation of the railway disruption control plan, including provision of a draft plan for comment prior to completion. Where the plan concerns the Caltrain right-of-way and facilities,

Caltrain will approve the plan. The Authority will review and approve the final plan only after Caltrain approval relative to Caltrain right-of-way and facilities.

- As part of the railway disruption control plan, the contractor will prepare a track closure contingency plan for every proposed track closure describing the duration of closure and the alternative arrangements to facilitate freight operations, including approval of freight operations during daytime during weekdays (if feasible and approved by Caltrain).
- The contractor will notify Caltrain, UPRR, and freight operators and users of any planned mainline track closures or limitations of access to other rail facilities (spur tracks, rail yards, and maintenance facilities) at least 3 months prior to the closure or limitation of access.

The Authority will minimize disruption to freight and tenant passenger services during project construction, while allowing for expeditious completion of construction. Measures that will be implemented throughout the course of project construction will include, but will not be limited to, the following:

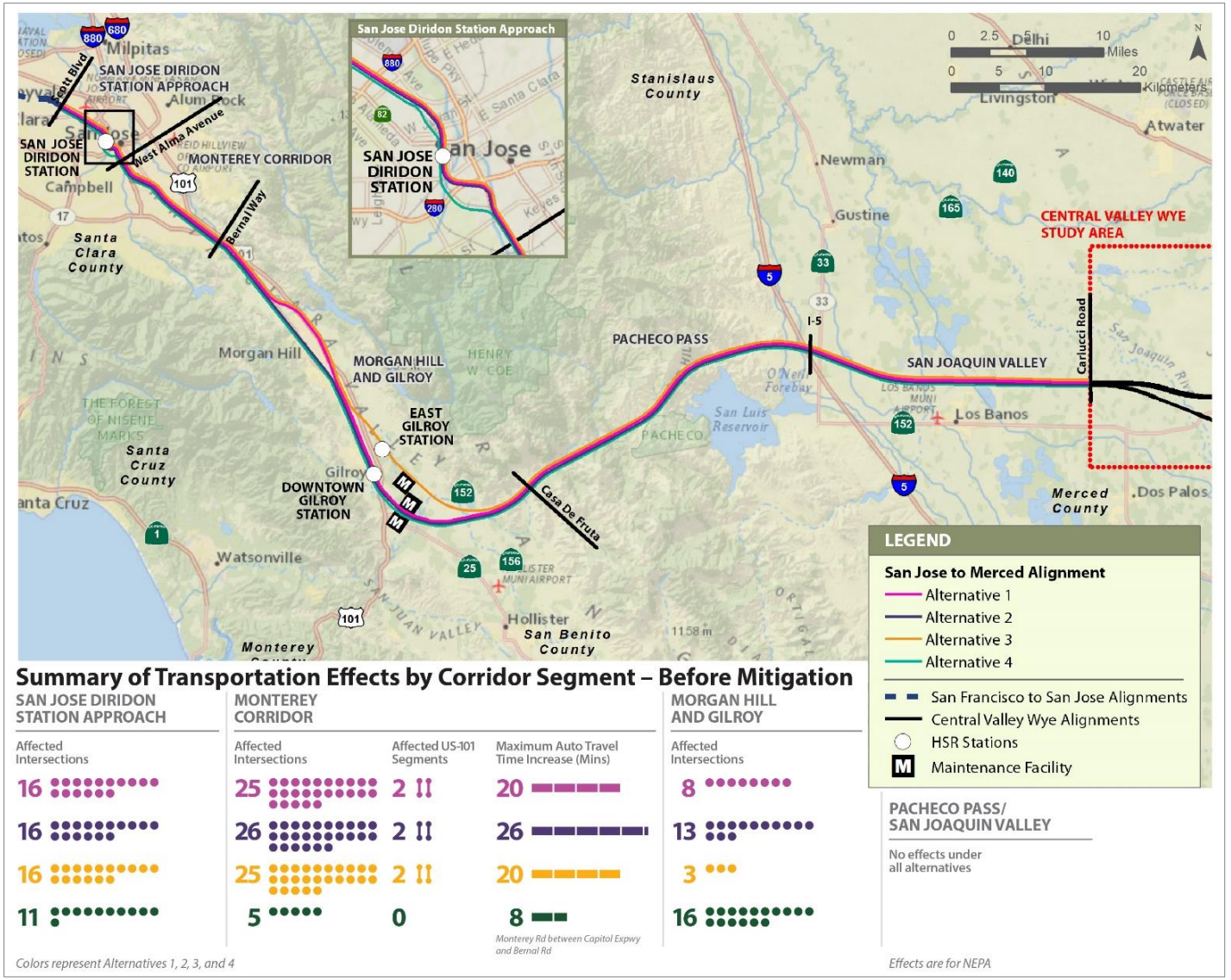
- Limit number of simultaneous track closures within each subsection, with closure timeframe limited as much as feasible for each closure, unless bypass tracks or alternative routes are available.
- Provide safety measures for freight and passenger rail operation through construction zones.
- Require contractors to coordinate with rail dispatch to minimize disruption of rail service in the corridor.
- Where feasible, limit closure of any tracks for construction activities to periods when train service is less frequent (e.g., weekends, or midday and late evening periods on weekdays).
- Where one open track cannot be maintained for passenger or freight use, limit multitrack closures to one location at a time, as much as feasible.
- Where multitrack closures result in temporary suspension of passenger rail service, work with local and regional transit providers to provide alternative transit service around the closure area (e.g., increased bus and shuttle service).
- Where multitrack closures result in temporary suspension of freight rail service, work with UPRR and freight operators and users to schedule alternative freight service timing to minimize disruption to freight customers.
- Provide advance notice to transit riders of any temporary disruption in passenger rail service.

With Alternatives 1 and 4, the Authority will provide a bus bridge from the College Park Station to the Santa Clara Station and San Jose Diridon Station to maintain passenger access to Caltrain service during the 1 to 2 years that the station will be closed because of track work.

This mitigation measure will be effective in minimizing the disruption of passenger and freight rail services during project construction. Implementing TR-MM#3 would not result in secondary impacts because it is anticipated that all identified improvements will occur in the existing rights-of-way or in the project footprint of the project alternatives.

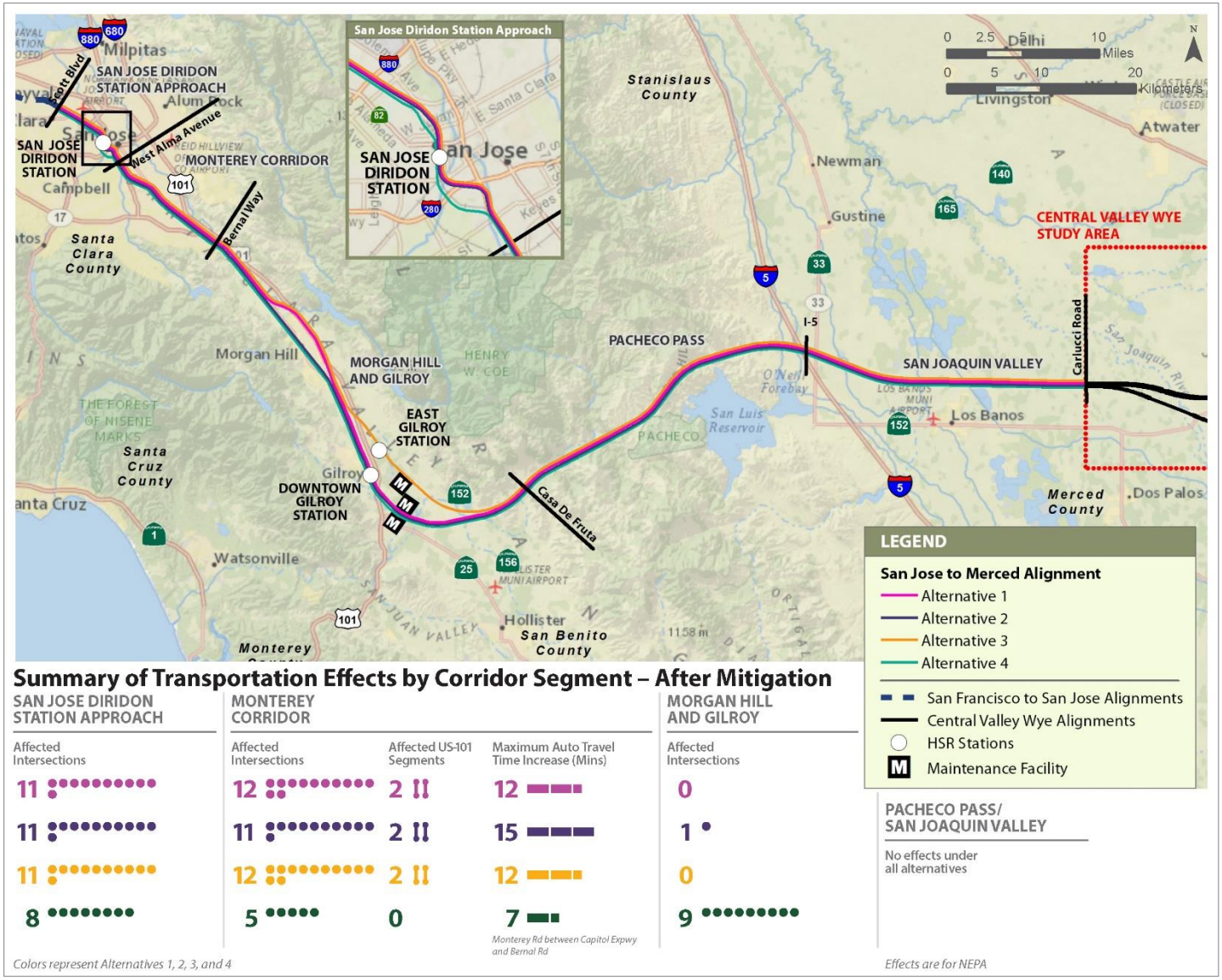
3.2.8 Impact Summary for NEPA Comparison of Alternatives

As described in Section 3.1.6.4, NEPA requires the comparison of the impacts of project actions to the No Project conditions when evaluating the impact of the project on the resource. The context and intensity of the changes caused by construction and operations of the project determine the level of impact. Figure 3.2-11a and b and Table 3.2-26 compare the project impacts before mitigation by alternative and are followed by a summary of the impacts.



MARCH 2021

Figure 3.2-11a Summary of 2040 with Project Transportation Effects by Subsection before Mitigation



MARCH 2021

Figure 3.2-11b Summary of 2040 with Project Transportation Effects by Subsection after Mitigation

Table 3.2-26 Comparison of Project Alternative Impacts for Transportation

Impacts	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Roadways, Freeways, and Intersections				
Impact TR#1: Temporary Congestion/Delay Consequences on Major Roadways, Freeways, and Intersections from Temporary Road Closures, Relocations, and Modifications	Temporary road closures and realignments would result in increases in travel times, delays, and inconvenience to the traveling public. ▪ San Jose Diridon Subsection—least impact among alternatives. ▪ Monterey Corridor Subsection—narrowing Monterey Road would affect 23 intersections. ▪ Morgan Hill and Gilroy Subsection—viaduct construction through downtown Gilroy would have fewer impacts than embankment. ▪ Pacheco Pass Subsection—impacts would be identical under all four alternatives. ▪ San Joaquin Valley—impacts would be identical under all four alternatives, closures and relocations along Henry Miller Road. The CTP would maintain traffic flow on major roadways, freeways, and intersections.	Temporary road closures and realignments would be greatest under Alternative 2. ▪ San Jose Diridon Subsection—would extend viaduct 2.4 miles farther north, affecting two additional overcrossings. ▪ Monterey Corridor Subsection—narrowing Monterey Road would affect 23 intersections. Embankment would require construction of five additional roadway overcrossings. ▪ Morgan Hill and Gilroy Subsection—greatest impact among alternatives from embankment construction through urban area. ▪ Pacheco Pass Subsection—Same as Alternative 1. ▪ San Joaquin Valley—Same as Alternative 1. The CTP would maintain traffic flow on major roadways, freeways, and intersections.	Temporary road closures and realignments would result in the least disruption of roadways under Alternative 3. ▪ San Jose Diridon Subsection—Same as Alternative 2. ▪ Monterey Corridor Subsection—narrowing Monterey Road would affect 23 intersections. ▪ Morgan Hill and Gilroy Subsection—least impact among alternatives from viaduct construction through rural area. ▪ Pacheco Pass Subsection—Same as Alternative 1. ▪ San Joaquin Valley— Same as Alternative 1. The CTP would maintain traffic flow on major roadways, freeways, and intersections.	Temporary road closures and realignments would result in increases in travel times, delays, and inconvenience to the traveling public. ▪ San Jose Diridon Subsection—similar impacts as Alternative 1. ▪ Monterey Corridor Subsection—least impact among alternatives because Monterey Road would not be narrowed. ▪ Morgan Hill and Gilroy Subsection—at-grade construction through downtown Gilroy would have fewer impacts than embankment. ▪ Pacheco Pass Subsection—impacts would be identical under all alternatives. ▪ San Joaquin Valley— Same as Alternative 1. The CTP would maintain traffic flow on major roadways, freeways, and intersections.

Impacts	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact TR#2: Temporary Congestion/Delay Consequences on Major Roadways, Freeways, and Intersections from Construction Vehicles	Project features such as the CTP and establishment of designated construction truck routes will control and manage construction vehicle traffic to minimize impacts on local vehicle circulation, delays, reductions in LOS, operations hazards, or loss of access to residences and community facilities.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact TR#3: Permanent Congestion/Delay Consequences on Roadways and Freeways from Permanent Road Closures and Relocations	18 permanent road closures and 26 permanent roadway modifications would increase vehicle traffic and degrade the LOS on US 101 in two segment locations from reduced capacity on Monterey Road.	30 permanent road closures and 45 permanent roadway modifications would increase vehicle traffic and degrade the LOS on US 101 in two segment locations from reduced capacity on Monterey Road.	17 permanent road closures and 24 permanent roadway modifications would increase vehicle traffic and degrade the LOS on US 101 in two segment locations from the reduced capacity on Monterey Road.	15 permanent road closures and 34 permanent roadway modifications would increase vehicle traffic congestion but would not degrade the LOS on US 101.
Impact TR#4: Permanent Congestion/Delay Consequences on Intersections from Permanent Road Changes	Permanent road closures and modifications would affect 14 intersections operating at LOS E or F, including 13 intersections in Monterey Corridor and 1 intersection in Morgan Hill and Gilroy in the Existing Plus Project conditions. With proposed mitigation, effects will be reduced at 4 of these intersections in Monterey Corridor and 1 intersection in Morgan Hill and Gilroy.	Permanent road closures and modifications would affect 17 intersections operating at LOS E or F, including 13 intersections in Monterey Corridor and 4 intersections in Morgan Hill and Gilroy in the Existing Plus Project conditions. With proposed mitigation, effects will be reduced at 6 intersections in Monterey Corridor and 4 intersections in Morgan Hill and Gilroy.	Same as Alternative 1	Permanent road closures and modifications would affect 2 intersections operating at LOS E or F in Morgan Hill and Gilroy in the Existing Plus Project conditions. Proposed mitigation will not reduce effects at these intersections.

Impacts	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact TR#5: Continuous Permanent Impacts on Vehicle Miles Traveled	By 2029, the project would reduce overall total VMT in Santa Clara County by 159 million miles, interregional VMT in San Benito County by 99 million miles, and interregional VMT in Merced County by 125 million miles. By 2040, the project would reduce overall total VMT in Santa Clara County by 230 million miles, interregional VMT in San Benito County by 170 million miles, and interregional VMT in Merced County by 200 million miles. If fully built out, the HSR project is forecast to reduce annual state-wide VMT by 5.7 billion in 2029 and 7.2 billion in 2040.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact TR#6: Continuous Permanent Congestion/Delay Consequences on Freeway Operations	A lane reduction along Monterey Road would affect two freeway segments along US 101 in southern San Jose from congestion.	Same as Alternative 1	Same as Alternative 1	No lane reduction along Monterey Road. Less traffic would shift to US 101 than under the other project alternatives and no freeway segments would be affected.

Impacts	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact TR#7: Permanent Continuous Congestion/Delay Consequences on Intersection Operations	Increased project extent traffic and changes to the roadway network would affect 46 intersections operating at LOS E or F in 2029 and 49 intersections in 2040 in the San Jose Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections. With the proposed mitigation, this will be reduced to 23 intersections operating at LOS E or F in 2040 in the San Jose Diridon Station Approach and Monterey Corridor Subsections.	Increased project extent traffic and changes to the roadway network would affect 49 intersections operating at LOS E or F in 2029 and 55 intersections in 2040, resulting in the most intersection operations effects of the four alternatives. With the proposed mitigation, this will be reduced to 24 intersections operating at LOS E or F in 2040 in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections.	Increased project extent traffic and changes to the roadway network would affect 41 intersections operating at LOS E or F in 2029 and 44 intersections in 2040. With the proposed mitigation, this will be reduced to 23 intersections operating at LOS E or F in 2040 in the San Jose Diridon Station Approach and Monterey Corridor Subsections.	Increased project extent traffic and changes to the roadway network would affect 27 intersections operating at LOS E or F in 2029 and 32 intersections in 2040 in the San Jose Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections. With the proposed mitigation, this will be reduced to 22 intersections operating at LOS E or F in 2040 in San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections.
Parking				
Impact TR#8: Temporary Construction-Related Effects on Parking	Some public parking may require temporary closure during construction; project features will limit impacts on public parking by providing parking for construction vehicles minimizing the time parking facilities are inoperable, and providing temporary replacement of displaced special event parking for the SAP Center.	Same as Alternative 1	Same as Alternative 1 for San Jose Diridon Station and SAP Center. For East Gilroy Station, all parking demands would be met by project parking facilities.	Same as Alternative 1, except that temporary effects on parking at the San Jose Diridon Station and SAP Center would be much smaller (displacement of up to 397 parking spaces without the DDV and 432 parking spaces with the DDV vs. displacement of up to 2,083 spaces) and permanent displacement of existing spaces would be less (up to 213 spaces without the DDV and 277 spaces with the DDV vs. up to 473 spaces). Temporary displacement of special event parking during construction would be replaced on a 1:1 basis.

Impacts	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact TR#9: Permanent Effects Related to Parking	No permanent loss of parking would occur related to the San Jose Diridon Station or Downtown Gilroy Station. Parking demands related to the San Jose Diridon Station and SAP Center can be met by existing facilities, project facilities, and the offsetting effects of increased transit service. Projected parking demands would be met by project parking facilities at the Downtown Gilroy Station.	Same as Alternative 1	Same as Alternative 1 for San Jose Diridon Station and SAP Center. For East Gilroy Station, all parking demands would be met by project parking facilities.	Permanent displacement of parking spaces near San Jose Diridon Station/SAP Center would also be replaced on a 1:1 basis.
Transit				
Impact TR#10: Temporary Impacts on Bus Transit	For all project alternatives, construction vehicles or temporary roadway closures would result in interference with bus routes and bus stops.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact TR#11: Temporary Impacts on Passenger Rail Operations	Station construction in San Jose and Gilroy, and relocation of tracks in the San Jose Diridon Station Approach Subsection would result in temporary disruptions of Caltrain, ACE, Capitol Corridor, and Amtrak services. Alternative 1 would modify the tracks leading to the Caltrain College Park Station resulting in closure for 1 to 2 years.	Station construction in San Jose and Gilroy and relocation of tracks in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections would result in temporary disruptions of Caltrain, ACE, Capitol Corridor, and Amtrak passenger rail services. The construction of new grade separations and the temporary relocation of Caltrain stations in the Monterey Corridor and the Morgan Hill and Gilroy Subsections would also result in disruption to existing passenger rail. This alternative would have the most impacts on passenger rail operations among the alternatives.	Station construction in San Jose and relocation of tracks in the San Jose Diridon Station Approach Subsections would result in temporary disruptions of Caltrain, ACE, Capitol Corridor, and Amtrak passenger rail services. This alternative would have the least disruption of passenger rail service.	Station construction in San Jose and Gilroy and relocation of tracks in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections would result in temporary disruptions of Caltrain, ACE, Capitol Corridor, and Amtrak services. The temporary relocation and reconstruction of Caltrain stations in the Monterey Corridor and Morgan Hill and Gilroy Subsections would also result in disruption to passenger rail service. This alternative would have the second-most impacts on passenger rail operations among the alternatives.

Impacts	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact TR#12: Permanent Impacts on Bus Transit	Five high-frequency bus routes would experience delays from reduction of capacity on Monterey Road.	Same as Alternative 1	Same as Alternative 1	One high-frequency bus route would experience delays from reduction of capacity due to road closures in and near the Downtown Gilroy Station area.
Impact TR#13: Continuous Permanent Impacts on Bus Services	10 high-frequency bus routes in the San Jose Diridon Station area, along Monterey Road and in the Downtown Gilroy Station area would be delayed because of project-related trips and roadway network changes.	Same as Alternative 1	10 high-frequency bus routes in the San Jose Diridon Station area and along Monterey Road would be delayed because of project-related trips and roadway network changes.	10 high-frequency bus routes in the San Jose Diridon Station area, along Monterey Road and in the Downtown Gilroy Station area would be delayed because of project-related trips and roadway network changes. This alternative would have the most impacts because of additional delays on at-grade crossings.
Impact TR#14: Continuous Permanent Impacts on Passenger Rail and Bus Access	Passenger rail and bus access will be accommodated by project design and project features. The project would not affect the performance of these services.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact TR#15: Continuous Permanent Impacts on Transit Ridership	Transit ridership would increase but would not hinder service by other transit providers or be inconsistent with transit plans and policies.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact TR#16: Continuous Permanent Impacts on Passenger Rail System Capacity	Caltrain average service times would increase slightly from the blending of service with HSR between Scott Boulevard and I-880, but a regular interval schedule would be maintained. The project would not materially decrease the performance of passenger rail services.	HSR would only operate on dedicated tracks and would not affect other passenger rail service capacity.	Same as Alternative 2	Same as Alternative 1 for blending with Caltrain north of Diridon. Blending service with Caltrain south of Diridon would not impair existing capacity.

Impacts	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Nonmotorized Travel				
Impact TR#17: Temporary Impacts on Pedestrian and Bicycle Access	Pedestrian and bicycle access would be temporarily impeded, but project features will maintain safe and adequate access.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact TR#18: Permanent Impacts on Pedestrian and Bicycle Access	Construction would require changes to pedestrian and bicycle facilities, but the project would be designed to maintain safe and accessible facilities.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact TR#19: Continuous Permanent Impacts on Pedestrian and Bicycle Access	Operations would introduce nonmotorized trips around station areas, but the project would be designed to maintain or enhance pedestrian and bicycle access, providing safe and accessible facilities.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Freight Rail Service				
Impact TR#20: Temporary Impacts on Freight Rail Operations	Station construction in San Jose and Gilroy and relocation of tracks in the San Jose Diridon Station Approach Subsection would result in temporary disruptions of freight rail services. Disruptions in other subsections would be limited.	Station construction in San Jose and Gilroy and relocation of tracks in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections would result in temporary disruptions of freight rail services. The construction of new grade separations in the Monterey Corridor and Morgan Hill and Gilroy Subsections would result in the disruption to existing freight rail. This alternative would have the greatest impact on freight rail of the alternatives.	Station construction in San Jose and relocation of tracks in the San Jose Diridon Station Approach Subsection would result in temporary disruptions of freight rail services. This alternative would result in the least disruption of freight rail service.	Station construction in San Jose and Gilroy and relocation of tracks in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections would result in temporary disruptions of freight rail services. The construction of relocated Caltrain stations in the Monterey Corridor and Morgan Hill and Gilroy Subsections would result in disruption to existing freight rail. This alternative would have the second-most impact on freight rail of the alternatives.

Impacts	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact TR#21: Continuous Permanent Impacts on Freight Rail Capacity	Shared track with freight between Scott Boulevard and CP Coast would result in disruptions to freight service and would result in temporal displacement but would not likely divert freight rail service to other modes.	This alternative would not include any shared track and would have no impact on freight service because of sharing of track.	Same as Alternative 2	Same as Alternative 1 for shared track with freight between Scott Blvd. and CP Coast. Freight would have separate track south of CP Coast and capacity would be maintained
Impact TR#22: Continuous Permanent Impacts on Freight Rail Operations	The project design and the HSR OCS installation would accommodate required freight height clearances where tracks are shared between CP Coast and Scott Boulevard	The project would not include any shared tracks with freight and thus would have no impacts related to the OCS and freight heights.	Same as Alternative 2	Same as Alternative 1

ACE = Altamont Corridor Express
CP = Control Point
CTP = construction transportation plan
DDV = Diridon design variant
HSR = high-speed rail
LOS = level of service
OCS = overhead contact system
TDV = tunnel design variant
US = U.S. Highway
VMT = vehicle miles traveled

3.2.8.1 Roadways, Freeways, and Intersections

Table 3.2-26 shows the temporary impacts on major roadways, freeways, and intersections from temporary road closures and relocations during construction. These impacts will be minimized through project features such as standard construction procedures, dedicated traffic control plans, and a CTP (TR-IAMF#2). The CTP, which will be reviewed and approved by the Authority, will provide a traffic control plan that will identify when and where temporary closures and detours will occur, with the goal of maintaining traffic flow, especially during peak travel periods. However, impacts at intersections on Monterey Road during construction cannot be avoided entirely.

Temporary impacts on parking, major roadways, freeways, and intersections from construction vehicle operations will be minimized through the implementation of a CTP (TR-IAMF#2) and providing off-street parking for construction vehicles (TR-IAMF#3). All project-related truck traffic, either for excavation or for transporting construction materials to the site, will use the designated truck routes in each city (TR-IAMF#7) to the extent feasible. Any temporary closure or removal of parking areas or roadways during construction would be restored upon completion of construction.

Project construction would result in permanent road closures and realignments that would have permanent impacts on intersection operations and freeway segments from congestion. These are delineated in Appendix 2-A, Roadway Crossings, Modifications, and Closures. Construction would require changes and closures to be made throughout the roadway network to accommodate the stations, platforms, track alignment and MOWFs. The types of roadway modifications would be similar under Alternatives 1, 2, and 3. Under Alternative 4, Monterey Road would not be narrowed. Mitigation measures are available to address permanent effects on intersection operations from permanent road closures, narrowing and relocations, and other intersection delay causes, as described in TR-MM#1.

Project operations would result in permanent effects on freeway operations and intersection operations. For Alternatives 1, 2, and 3, a lane reduction along Monterey Road would affect two freeway segments in the Monterey Corridor Subsection because some traffic would divert to US 101, increasing congestion on the freeway. Mitigation measures are not proposed to address permanent effects on freeway operations from project operations, for the reasons described in Section 3.2.7. Under all project alternatives, increased traffic and changes to the roadway network would affect intersections because of congestion. Mitigation measures are available to address permanent impacts on intersection operations from project operations, as described in TR-MM#1(a-u). However, feasible mitigation is not available at a number of locations. The proposed mitigation will address adverse effects as follows:

- Alternative 1: Of 49 intersections with adverse effects, mitigation will avoid adverse effects at 26 intersections, leaving adverse effects at 23 locations;
- Alternative 2: Of 55 intersections with adverse effects, mitigation will avoid adverse effects at 31 intersections, leaving adverse effects at 24 locations;
- Alternative 3: Of 44 intersections with adverse effects, mitigation will avoid adverse effects at 21 intersections, leaving adverse effects at 23 locations; and
- Alternative 4: Of 32 intersections with adverse effects, mitigation will avoid adverse effects at 10 intersections, leaving adverse effects at 22 locations.

Project operations would change regional and statewide travel patterns and result in a reduction of VMT in the RSA, region, and state. Although there would be localized congestion resulting from the project, VMT would be reduced regionally in the project extent because of decreases in long-range vehicle trips and increases in HSR ridership, resulting in less overall congestion.

3.2.8.2 Parking

Project construction would temporarily displace parking in certain areas within the construction footprint, including at and adjacent to the San Jose Diridon Station (all alternatives) and the Downtown Gilroy Station (Alternatives 1, 2, and 4), including parking used for special events at the SAP Center. Project features will minimize temporary effects on parking through identification

of employee parking locations (TR-IAMF#2), off-street parking for construction-related vehicles (TR-IAMF#3), and replacement on a 1:1 basis for temporary displacement of special event parking at the SAP Center (TR-IAMF #8).

Project operations would permanently displace parking at and adjacent to the San Jose Diridon Station (all alternatives), the SAP Center (all alternatives), and the Downtown Gilroy Station (Alternatives 1, 2, and 4), but the project includes construction of replacement parking on a 1:1 basis, so there would be no permanent reduction of available parking at these locations. Increased parking demands caused by HSR riders at the San Jose Diridon Station (all alternatives) would be accommodated through existing parking facilities, project parking facilities, and the offsetting effects of increased transit service to the station so that station user and SAP Center parking demands can be met without secondary environmental or socioeconomic effects. Parking demands at the Downtown Gilroy Station (Alternatives 1, 2, and 4) and the East Gilroy Station (Alternative 3) would be met by proposed station parking.

3.2.8.3 Transit

Project construction would involve the temporary closure of bus stops, parking areas, transit stations, and roadway travel lanes. Project features will minimize temporary impacts on bus operations through the implementation of the CTP and CMP (TR-IAMF#11). Available mitigation includes installing transit signal priority prior to construction (TR-MM#2). Permanent impacts on bus operations would result from permanent road closures and roadway modifications that would reduce capacity and shift traffic. Available mitigation includes installing transit signal priority (TR-MM#2). Project construction would result in temporary impacts on passenger rail operations from temporary closure or removal of passenger rail stations, platforms, and track. To minimize conflicts and disruption, project features include implementation of CMPs, a CTP, and construction of temporary tracks (TR-IAMF#9). Available mitigation includes a railway disruption control plan (TR-MM#3).

Project operations would result in continuous permanent impacts on bus services, with delays caused by increased congestion along 11 bus routes. Available mitigation includes installing transit signal priority (TR-MM#2). Project operations would not result in continuous permanent impacts on passenger rail and bus access. Passengers would be able to access these services unimpeded because of project features such as station design that will take into account the changes in demand and will provide access for passengers using HSR as well as bus and other passenger rail services. Project operations would have continuous permanent impacts on transit ridership by increasing overall passenger rail ridership. HSR riders would create new demands for Caltrain and other transit systems because they would transfer from HSR to reach destinations served by these other systems. Additionally, HSR would compete with Caltrain for riders from Gilroy and San Jose northward. Project operations would have continuous permanent impacts on passenger rail system capacity, where the increase or decrease in average service times would vary depending on whether or not HSR has dedicated tracks or would share tracks with Caltrain.

3.2.8.4 Nonmotorized Travel

Project construction would result in temporary impacts on pedestrian and bicycle access from the temporary closure or removal of pedestrian facilities, bicycle lanes, and paths. Maintenance of pedestrian and bicycle access will minimize conflicts (TR-IAMF#4, TR-IAMF#5, and TR-IAMF#12). Project construction would result in permanent impacts on pedestrian and bicycle access from reconstruction and changes to pedestrian and bicycle facilities in HSR station areas or on roadways. Project features will provide and maintain pedestrian and bicycle accessibility across the HSR corridor, to and from stations, and on station property (TR-IAMF#12). Project operations would have continuous permanent impacts on pedestrian and bicycle access because of the potential for increased numbers of passengers at stations. Project features will maintain access across the HSR corridor (TR-IAMF#12).

3.2.8.5 *Freight Rail Service*

Project construction would result in temporary impacts on freight rail operations from temporary closure or relocation of tracks, which would vary by project alternative and subsection, and disruption and delay would last hours or days. Impacts would be minimized with shoofly tracks, scheduling, and the use of existing alternative tracks where available. Mitigation measures available include a railway disruption control plan (TR-MM#3). Installation of the project OCS would not affect height clearances for freight where tracks are shared with HSR. Project operations would not result in continuous permanent impacts on freight rail capacity because there would be no limiting of freight service from sharing of tracks in portions of different project alternatives. Freight operation hours would be constrained, which would cause changes in freight operations and inconvenience to operators, but freight operations overall would be maintained. Diversion of freight from rail to other modes is not likely to occur.

3.2.9 CEQA Significance Conclusions

As described in Section 3.1.6.4, analysts evaluated the impact of project actions against thresholds to determine whether a project action would result in no impact, a less-than-significant impact, or a significant impact under CEQA. Table 3.2-27 identifies the CEQA significance determinations for each impact discussed in Section 3.2.6, Environmental Consequences. A summary of the significant impacts, mitigation measures, and factors supporting the significance conclusion after mitigation follows the table.

Table 3.2-27 CEQA Significance Conclusions and Mitigation Measures for Transportation

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Scenario	Mitigation Measure	CEQA Level of Significance after Mitigation
Roadways, Freeways, and Intersections				
Impact TR#1: Temporary Congestion/Delay Consequences on Major Roadways, Freeways, and Intersections from Temporary Road Closures, Relocations, and Modifications	Alternatives 1, 2, and 3: Project construction would increase traffic congestion at 23 intersections on Monterey Road during construction. Alternative 4: Monterey Road would not be narrowed, but there would be temporary closures due to construction. This is not considered a significant impact under CEQA.	During construction	No mitigation measures are required.	N/A

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Scenario	Mitigation Measure	CEQA Level of Significance after Mitigation
Impact TR#2: Temporary Congestion/Delay Consequences on Major Roadways, Freeways, and Intersections from Construction Vehicles	Project construction would control and manage construction vehicle traffic through construction plans, standard construction practices, dedicated construction truck routes and parking resources, and restrictions on construction hours to minimize interference with local vehicle circulation, delays or reductions in LOS, operations hazards, or loss of access to residences and community facilities. This is not considered a significant impact under CEQA.	During Construction	No mitigation measures are required.	N/A
Impact TR#3: Permanent Delay/Congestion Consequences on Freeways and Roadways from Permanent Road Closures and Relocations	Alternatives 1, 2, and 3: Permanent road closures and relocations would substantially degrade the LOS and increase the V/C ratio of two freeway segments on US 101 from the reduced capacity on Monterey Road. This is not considered a significant impact under CEQA.	Existing Plus Project conditions	No mitigation measures are required.	N/A
Impact TR#4: Permanent Delay/Congestion Consequences on Intersections from Permanent Road Changes	Project construction would increase traffic congestion at 14, 16, 14, and 2 intersections around the stations under Alternatives 1, 2, 3, and 4, respectively. This is not considered a significant impact under CEQA.	Existing Plus Project conditions	No mitigation measures are required.	N/A

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Scenario	Mitigation Measure	CEQA Level of Significance after Mitigation
Impact TR#5: Continuous Permanent Impacts on Vehicle Miles Traveled	Less than significant for all alternatives: 2029 and 2040 Plus Project conditions would not result in a net increase of VMT over the baseline condition. The project would result in an overall decrease in VMT throughout the region and the state, resulting in a beneficial impact on VMT.	2029 and 2040 Plus Project conditions	No mitigation measures are required.	N/A
Impact TR#6: Continuous Permanent Delay/Congestion Consequences on Freeway Operations	Alternatives 1, 2, and 3: The lane reduction along Monterey Road would substantially degrade the LOS and increase the V/C ratio of two freeway segments on US 101. Alternative 4: Additional delays from gate down time at the at-grade crossings would shift traffic to US 101, but would not substantially degrade the LOS on any freeway segments. This is not considered a significant impact under CEQA.	2029 and 2040 Plus Project conditions	No mitigation measures are required.	N/A

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Scenario	Mitigation Measure	CEQA Level of Significance after Mitigation
Impact TR#7: Continuous Permanent Delay/Congestion Consequences on Intersection Operations	Project operations in 2029 would increase congestion at 46, 49, 41, and 27 intersections under Alternatives 1, 2, 3, and 4, respectively, from increased traffic and changes to the roadway network. Project operations in 2040 would increase congestion at 49, 55, 43, and 31 intersections under Alternatives 1, 2, 3, and 4, respectively, from increased project traffic and changes to the roadway network. This is not considered a significant impact under CEQA.	2029 and 2040 Plus Project conditions	No mitigation measures are required.	N/A
Parking				
Impact TR#8: Temporary Construction-Related Effects on Parking	Temporary effects on parking would be minimized through 1:1 replacement of SAP Center special event parking during construction.	Construction	No mitigation measures are required.	N/A
Impact TR#9: Permanent Effects Related to Parking	No permanent loss of parking would occur at or near stations. Parking demands can be met by either proposed parking facilities (Gilroy) or by combination of existing and project facilities and offsetting effect of increased transit service (San Jose Diridon/SAP Center). As a result, no secondary physical effects related to parking would occur.	Operations	No mitigation measures are required.	N/A

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Scenario	Mitigation Measure	CEQA Level of Significance after Mitigation
Transit				
Impact TR#10: Temporary Impacts on Bus Transit	Significant for all alternatives: Project construction would minimize decreases to the performance of bus transit facilities because it would control and manage construction vehicle traffic, but material decreases in performance of certain bus routes would still occur.	During Construction	TR-MM#2: Install Transit Signal Priority	Significant and Unavoidable (Alternatives 1, 2, and 3) Less than Significant (Alternative 4)
Impact TR#11: Temporary Impacts on Passenger Rail Operations	Significant for all alternatives: Project construction would temporarily disrupt passenger rail service and decrease passenger rail operation performance in the San Jose Diridon Station Approach Subsection and for Alternatives 2 and 4 in the Monterey Corridor, and Morgan Hill and Gilroy Subsections.	During Construction	TR-MM#3: Railway Disruption Control Plan	Less than Significant
Impact TR#12: Permanent Impacts on Bus Transit	Significant for all alternatives: Project construction would lead to delays along five bus routes from reduction of capacity on Monterey Road.	Existing Plus Project conditions	TR-MM#2: Install Transit Signal Priority	Less than Significant
Impact TR#13: Continuous Permanent Impacts on Bus Services	Significant for all alternatives: Project operations would lead to delays along 10 bus routes because of project-related trips and roadway network changes, resulting in the decrease of bus operation performance.	2029 and 2040 Plus Project conditions	TR-MM#2: Install Transit Signal Priority	Less than Significant

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Scenario	Mitigation Measure	CEQA Level of Significance after Mitigation
Impact TR#14: Continuous Permanent Impacts on Passenger Rail and Bus Access	Less than significant for all alternatives: Project operations would not impede passenger access to other passenger rail and bus services and would therefore not decrease the performance of these services.	2029 and 2040 Plus Project conditions	No mitigation measures are required.	N/A
Impact TR#15: Continuous Permanent Impacts on Transit Ridership	Less than significant for all alternatives: Project operations would increase transit ridership, but would not result in inconsistencies with transit plans and policies and would not hinder transit operations or planned expansions.	2029 and 2040 Plus Project conditions	No mitigation measures are required.	N/A
Impact TR#16: HSR Continuous Permanent Impacts on Passenger Rail System Capacity	Less than significant for all alternatives: Project operations would not diminish transit system capacity and would not conflict with adopted policies, plans, or programs regarding public transit, or decrease the performance of transit systems.	2029 and 2040 Plus Project conditions	No mitigation measures are required.	N/A
Nonmotorized Travel				
Impact TR#17: Temporary Impacts on Pedestrian and Bicycle Access	Less than significant for all alternatives: Project construction would not decrease the performance of pedestrian and bicycle facilities, because it would maintain adequate access.	During Construction	No mitigation measures are required.	N/A

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Scenario	Mitigation Measure	CEQA Level of Significance after Mitigation
Impact TR#18: Permanent Impacts on Pedestrian and Bicycle Access	Less than significant for all alternatives: Project construction would not decrease the performance of pedestrian and bicycle facilities because it would provide accessible bicycle and pedestrian facilities.	Existing Plus Project conditions	No mitigation measures are required.	N/A
Impact TR#19: Continuous Permanent Impacts on Pedestrian and Bicycle Access	Less than significant for all alternatives: Project operations would not decrease the performance of pedestrian and bicycle facilities, because it would provide accessible bicycle and pedestrian facilities.	2029 and 2040 Plus Project conditions	No mitigation measures are required.	N/A
Freight Rail Service				
Impact TR#20: Temporary Impacts on Freight Rail Operations	Significant for all alternatives: Project construction would temporarily disrupt freight rail service and decrease freight rail operation performance in the San Jose Diridon Station Approach Subsection and for Alternatives 2 and 4 in the Monterey Corridor, and Morgan Hill and Gilroy Subsections.	During Construction	TR-MM#3: Railway Disruption Control Plan	Less than Significant

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Scenario	Mitigation Measure	CEQA Level of Significance after Mitigation
Impact TR#21: Continuous Permanent Impacts on Freight Rail Capacity	No impact for Alternatives 2 and 3. Less than significant for Alternative 1: Sharing of tracks with Alternatives 1 and 4 would not divert freight rail service to other modes and would not disrupt or interfere with freight operations or create changes that would result in significant secondary impacts on air quality, noise, GHG emissions, or traffic operations.	2029 and 2040 Plus Project conditions	No mitigation measures are required.	N/A
Impact TR#22: Continuous Permanent Impacts on Freight Rail Operations	No impact for Alternatives 2 and 3. Less than significant for Alternatives 1 and 4: Operation of the OCS would not decrease the effective freight vehicle height and thus would not divert freight rail service to other modes, disrupt or interfere with freight operations, or create changes that would result in significant secondary impacts on air quality, noise, GHG emissions, or traffic operations.	2029 and 2040 Plus Project conditions	No mitigation measures are required.	N/A

CEQA = California Environmental Quality Act
GHG = greenhouse gases
LOS = level of service
N/A = not applicable
OCS = overhead contact system
US = U.S. Highway
V/C = volume-to-capacity
VMT = vehicles miles traveled

Impact TR#10: Temporary Impacts on Bus Transit

There would be a significant impact under all four project alternatives on bus transit operations during construction. Project-related construction staging and traffic would contribute to material decrease in bus route performance along roadways and at the existing San Jose Diridon and Downtown Gilroy Stations. Construction of the HSR stations, platforms, and track alignment would require TCEs. The TCE may require temporary closure of parking areas, bus stops, transit stations, or roadway travel lanes. Changes to bus routes and bus stops would be managed

through development and implementation of a CMP and CTP, but material decreases in certain bus routes would still occur.

The Authority would implement TR-MM#2 to reduce the impacts on bus transit operations. This mitigation measure will improve bus transit operations on Monterey Road (Alternatives 1, 2, and 3) and in the San Jose Diridon Station and the Gilroy Station areas (all alternatives) by installing transit signal priority at key intersections. This mitigation measure is described in Section 3.2.7. Because mitigation will support continued bus transit operations with improvements at these locations, the impact will be less than significant at these locations provided road/lane closures are not required along the bus transit route. For Alternative 4, implementation of this mitigation would reduce impacts to a less-than-significant level because Alternative 4 would not require road/lane closures along high-frequency bus routes. For Alternatives 1, 2, and 3, the impact would be significant and unavoidable due to unavoidable road/lane closures at certain locations (transit signal priority will not avoid bus transit delays at the temporary road/lane locations themselves).

Impact TR#11: Temporary Impacts on Passenger Rail Operations

There would be a temporary significant impact under all four project alternatives on passenger rail operations. Construction of the HSR stations, platforms, and track alignment would require TCEs. The TCE may require temporary closure of transit stations, passenger rail platforms, and passenger rail track. Any closure or removal of passenger rail stations, platforms, and track during construction would be temporary. These activities would disrupt passenger rail and result in commuter inconvenience and diversion from transit to other commute modes.

The Authority would implement TR-MM#3 to reduce the impacts on passenger rail. The railway disruption control plan would minimize the duration of construction in areas that would require temporary closures, limit construction hours, and plan for coordination between the construction contractor and passenger rail service providers so that disruptions would be limited to a maximum of several hours or several days. The implementation of the mitigation would reduce disruption levels to a less-than-significant level.

Impact TR#12: Permanent Impacts on Bus Transit

There would be a significant impact under all four project alternatives on bus transit operations. Permanent road closures and reduction in roadway capacity on Monterey Road would shift vehicle trips and reduce capacity along high-frequency VTA bus routes (routes with service every 15 minutes or less), contributing to bus performance delay. The project-related roadway modifications would affect bus on-time performance and operating speeds.

The Authority would implement TR-MM#2 to reduce the impacts on bus transit operations. This mitigation measure will improve bus transit operations on Monterey Road and in the San Jose Diridon Station and the Gilroy station areas by installing transit signal priority at key intersections. This mitigation measure is described in Section 3.2.7. Because mitigation will support continued bus transit operations with improvements, the impact will be less than significant.

Impact TR#13: Continuous Permanent Impacts on Bus Services

There would be a significant impact under CEQA for all project alternatives on bus transit operations. Vehicle trips around the stations would increase because of the addition of passengers and HSR workers traveling to station areas. This added traffic would lead to increased volume, congestion, and delays around San Jose Diridon and Gilroy Stations. In addition, construction of the road diet of Monterey Road would result in reduced capacity on the Monterey Corridor and adjacent roadways, leading to congestion and delays at intersections along Monterey Road and along adjacent roadways. The increased congestion and delay because of the project would occur along high-frequency VTA bus routes (routes with service every 15 minutes or less), contributing to bus performance delay. The addition of project-related vehicle trips would affect bus on-time performance and operating speeds. All project alternatives would add project-related trips affecting 10 high-frequency bus routes near San Jose Diridon Station, Monterey Road, and Gilroy Station.

The Authority would implement TR-MM#2 to reduce the impacts on bus transit operations. This mitigation measure will improve bus transit operations on Monterey Road and in the San Jose Diridon Station and Gilroy station areas by installing transit signal priority at key intersections. This mitigation measure is described in Section 3.2.7. Because mitigation will support continued bus transit operations with improvements, the impact will be less than significant.

Impact TR#20: Temporary Impacts on Freight Rail Operations

There would be a significant impact under CEQA for all project alternatives on freight rail operations. Because freight rail operations occur in the rail rights-of-way used for portions of the construction, construction would disrupt freight rail operations. Construction would disrupt freight rail services, which would result in freight operator and customer inconvenience and potentially temporary diversion to other freight modes.

The Authority would implement TR-MM#3 to reduce the impacts on freight rail. The railway disruption control plan would minimize the duration of construction in areas that would require temporary closures, limit construction hours, and plan for coordination between the construction contractor and freight rail service providers such that disruptions would be limited to a maximum of a few hours or a few days. The implementation of the mitigation would reduce disruption to a less-than-significant level.

3.3 Air Quality and Greenhouse Gases

Since publication of the Draft Environmental Impact Report (EIR)/Environmental Impact Statement (EIS), the following substantive changes have been made to this section:

- A section was added to Section 3.3.2.1, Federal, regarding the Federal Railroad Administration (FRA) Procedures for Considering Environmental Impacts. Footnotes were added regarding FRA's Environmental Procedures and the updated Council on Environmental Quality (CEQ) regulations issued after release of the Draft EIR/EIS.
- Emissions generated by light-duty gasoline-powered vehicles used during construction were remodeled to include the effects of the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule. As stated in Section 3.3.4.3, Methods for Impact Analysis, the adjustment factors were conservatively applied to the entire CalEEMod output for on-road mobile, which includes emissions contributions from gasoline and diesel-powered vehicles. The revised emissions results are presented in this Final EIR/EIS in Tables 3.3-12 to 3.3-14, 3.3-22 through 3.3-25, 3.3-28, 3.3-29, and 3.3-31 through 3.3-33. In April 2021, the National Highway Transportation Safety Administration (NHTSA) issued a notice of proposed rulemaking to repeal the SAFE Vehicles Rule.
- In Section 3.3.4.3, text was revised to state that, for risk factors for health risk assessment (HRA) calculations, all receptors were conservatively modeled with residential exposure parameters. This revision was made in response to public comments.
- In Section 3.3.4.3 and in Section 3.3.6.2, Greenhouse Gases, the percentage of future electricity generated by renewable resources required by state law was updated to 100 percent by 2045, pursuant to Senate Bill 100.
- The analysis now uses a lower *de minimis* threshold (i.e., 70 tons per year rather than 100 tons per year) for particulate matter smaller than or equal to 2.5 microns in diameter ($PM_{2.5}$) and sulfur dioxide (SO_2) in the San Joaquin Valley Air Basin (SJVAB), as shown in Table 3.3-3.
- Text describing the effects of nitrogen dioxide (NO_2) exposure on children and adults was expanded in Section 3.3.5.1, Air Quality. This revision was made in response to public comments.
- A table note was added to Table 3.3-7 clarifying SJVAB's 2006 and 2012 $PM_{2.5}$ attainment status.
- Refinements were made to the particulate matter mass emissions inventory to more comprehensively capture emissions reductions that would be achieved through implementation of AQ-IAMF#1: Fugitive Dust Emissions. These revisions were made for the final air quality analysis, as reported in Tables 3.3-12 through 3.3-14.
- A footnote was added to Tables 3.3-12 through 3.3-14 and Table 3.3-31 to explain that although construction is expected to take place later than the dates assumed in the air quality analysis, the emissions estimates are conservative, as future emissions rates will be lower due to the implementation of cleaner and newer equipment.
- Analysis about the Diridon design variant (DDV) and tunnel design variant (TDV), which was included in Section 3.20 in the Draft EIR/EIS, was incorporated into Section 3.3 in Impacts AQ#6, AQ#7, and AQ#14, including into Tables 3.3-26 and 3.3-31.
- The time for net greenhouse gas (GHG) reductions during operations to offset the increase in construction-related GHG emissions was updated to 8 to 14 months in Section 3.3.6.2. This revision was required to capture the updated emissions modeling, which reflect inclusion of the SAFE Rule and revised mitigation measures (discussed below).
- Draft EIR/EIS Mitigation Measure AQ-MM#2 was deleted due to the impact of the refinements to the particulate matter emissions inventory (discussed above). With these

refinements, none of the project alternatives would exceed Monterey Bay Air Resources District's (MBARD) coarse particulate matter (PM_{10}) threshold.

- A new air quality mitigation measure, AQ-MM#1: Implement Additional On-Site Emissions Controls to Reduce Fugitive Dust, was added in response to public comments.
- A new air quality mitigation measure, AQ-MM#2: Construction Emissions Reductions – Requirements for use of Zero Emission (ZE) and/or Near Zero Emission (NZE) Vehicles and off-road equipment, was added to this Final EIR/EIS to reflect the California High-Speed Rail Authority's (Authority) commitment to electric vehicles.
- Tables 3.3-30 and 3.3-32; Section 3.3.7, Mitigation Measures; Section 3.3.8, Impact Summary for NEPA Comparison of Alternatives; and Section 3.3.9, CEQA Significance Conclusions, were updated to reflect the changes to mitigation measures.
- Statewide operational GHG emissions from electrical generation were revised based on the U.S. Environmental Protection Agency's (USEPA) latest publication of the Emissions and Generation Resource Integrated Database (released January 2020) (USEPA 2020).
- Where appropriate, the verb "would," when used specifically to describe impact avoidance and minimization features (IAMFs) or mitigation measures, as well as their directly related activities, was changed to "will," indicating their integration into project design.

3.3.1 Introduction

This section describes ambient air quality conditions, including existing pollutant concentrations, meteorology, and locations of sensitive receptors in the San Jose to Central Valley Wye Project Extent (project or project extent) resource study area (RSA). This section also discusses applicable criteria pollutant and GHG regulations. Critical air quality issues along the construction footprint include short-term construction-related emissions, which could exceed local air district and federal General Conformity thresholds designed to achieve regional attainment with federal and state ambient air quality standards. Sensitive receptors adjacent to the construction footprint may also be exposed to increased health risks from construction activities. Long-term operations of the project would increase emissions from electrified passenger rail service, as well as attract additional motor vehicles to existing and new transit stations. However, the project would expand transit ridership, which would remove single-occupancy vehicles from the transportation network and reduce aviation demand. This analysis considers the net effect of the project on air quality and GHG conditions as a result of long-term operations.

Primary Air Quality and Greenhouse Gas Impacts

- Short-term construction emissions in excess of air district and federal *de minimis* thresholds
- Short-term construction emission concentrations in excess of ambient air quality standards
- Short-term conflict with air quality plans associated with construction-generated emissions
- Long-term criteria pollutant and greenhouse gas emissions reduction from removal of passenger vehicle and aircraft trips

The following appendices in Volume 2 of this Final EIR/EIS provide additional details on air quality and global climate change.

- Appendix 2-D, Applicable Design Standards, describes the relevant design standards for the project.
- Appendix 2-E, Project Impact Avoidance and Minimization Features, provides the list of all IAMFs incorporated into the project.
- Appendix 2-J, Regional and Local Plans and Policies, provides a list by resource of all applicable regional and local plans and policies.
- Appendix 2-K, Policy Consistency Analysis, provides a summary by resource of project inconsistencies and reconciliations with local plans and policies.

- Appendix 3.2-B, Vehicle Miles Traveled Forecasting, provides a summary memorandum from the Authority and a technical paper written by Cambridge Systematics describing the methodology used for forecasting the reduction in vehicle miles traveled (VMT).
- Appendix 3.3-A, San Jose to Merced Project Section Air Quality and Greenhouse Gases Technical Report (Air Quality and Greenhouse Gases Technical Report), provides additional technical details on the air quality and GHG analysis.
- Appendix 3.3-B, Draft Federal General Conformity Determination, provides a discussion of the federal General Conformity requirements and the information shared by the Authority with the FRA.
- Appendix 3.3-C, Changes to Project Benefits Based on 2018 Business Plan, describes how long-term operational benefits of the high-speed rail (HSR) project may change based on the ridership assumptions under the 2018 Business Plan.

Air quality and GHG are important considerations for development of the project alternatives because of their effect on human health and global climate change and current regional air quality conditions, which commonly exceed federal and state ambient air quality standards along portions of the project. Air quality conditions tend to be worse along the eastern portion of the RSA in the San Joaquin Valley and improve westward. The following Final EIR/EIS resource sections provide additional information related to air quality and global climate change:

- Section 3.10, Hazardous Materials and Wastes—Describes compliance with asbestos regulations and disposal of lead-based paint (LBP) during construction of the project.
- Section 3.18, Regional Growth—Evaluates impacts of constructing the project alternatives on land consumption, and growth-inducing impacts on air quality and global climate change.

The following are key definitions for air quality and global climate change analyzed in this Final EIR/EIS.

- **Air quality**—Describes the amount of air pollution to which the public is exposed.
- **Air pollution**—General term that refers to one or more chemical substances that degrade the quality of the atmosphere. Air pollutants degrade the atmosphere by reducing visibility, damaging property, and combining to form smog. Air pollutants affect humans by reducing the productivity or vigor of crops or natural vegetation, and by reducing human or animal health. Three general classes of air pollutants are of concern for the project: criteria pollutants, toxic air contaminants (TAC), and GHG. These pollutants are defined in detail in the Air Quality and Greenhouse Gases Technical Report, Chapter 4 (Volume 2, Appendix 3.3-A).
  - **Criteria pollutants**—Pollutants for which the USEPA and the State of California have set ambient air quality standards or that are chemical precursors to compounds for which ambient standards have been set. The six major criteria pollutants include ozone (O_3), particulate matter (PM) (PM_{10} is PM smaller than or equal to 10 microns in diameter and $PM_{2.5}$ is PM smaller than or equal than 2.5 microns in diameter), carbon monoxide (CO), NO_2, SO_2, and lead (Pb).[1] Ozone is considered a regional pollutant because its precursors affect air quality on a regional scale. Pollutants such as CO, NO_2, SO_2, and Pb are considered local pollutants that tend to accumulate in the air locally. PM is both a local and a regional pollutant. The primary criteria pollutants of concern generated by the

[1] The statewide standards established for California also incorporate standards for sulfates, hydrogen sulfide, vinyl chloride, and visibility-reducing particles.

project are ozone precursors (volatile organic compounds [VOC] and nitrogen oxides [NO_X]), CO, PM, and SO_2.[2]

- **TACs**—Nine mobile source air toxics (MSAT) identified by USEPA as having significant contributions from mobile sources: acrolein, benzene, 1,3-butadiene, acetaldehyde, diesel particulate matter (DPM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter. These pollutants are known or suspected to cause cancer or other serious health and environmental effects.
- **GHGs**—Gaseous compounds that limit the transmission of Earth's radiated heat out to space. GHGs include O_3, water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases (e.g., chlorofluorocarbons and hydrochlorofluorocarbons).

- **Global climate change**—Long-term changes in the Earth's climate, usually associated with recent global warming trends, as well as regional changes in weather and precipitation patterns, attributed to increasing concentrations of GHGs in the atmosphere.

3.3.2 Laws, Regulations, and Orders

This section presents federal, state, and regional and local laws, regulations, orders, and plans applicable to air quality and GHGs. The Authority would implement the HSR system, including the project, in compliance with all applicable regulations. Refer to the Air Quality and Greenhouse Gases Technical Report (Volume 2, Appendix 3.3-A) for more detailed information on laws, regulations, and orders.

3.3.2.1 Federal

Federal Railroad Administration, Procedures for Considering Environmental Impacts (64 Fed. Reg. 28545)

On May 26, 1999, FRA released *Procedures for Considering Environmental Impacts* (FRA 1999). These FRA procedures supplement the Council on Environmental Quality Regulations (40 C.F.R. Part 1500 et seq.) and describe the FRA's process for assessing the environmental impacts of actions and legislation proposed by the agency and for the preparation of associated documents (42 U.S. Code 4321 et seq.).[3,4] The FRA *Procedures for Considering Environmental Impacts* states that "the EIS should identify any significant changes likely to occur in the natural environment and in the developed environment. The EIS should also discuss the consideration given to design quality, art, and architecture in project planning and development as required by U.S. Department of Transportation Order 5610.4." These FRA procedures state that an EIS should consider possible impacts on air quality.

Clean Air Act (42 United States Code § 7401) and National Ambient Air Quality Standards

The federal Clean Air Act (CAA), promulgated in 1963 and amended several times thereafter, including the 1990 CAA amendments, establishes the framework for modern air pollution control in the United States. The CAA directs the USEPA to establish federal air quality standards, known as national ambient air quality standards (NAAQS), and specifies future dates for achieving compliance. The six major criteria pollutants subject to the NAAQS are O_3, PM (PM_{10}

[2] As noted, there are also ambient air quality standards for Pb, sulfates, hydrogen sulfide, vinyl chloride, and visibility particulates. However, these pollutants are typically associated with industrial sources, which are not included as part of the project. Accordingly, they are not discussed further within the context of project-generated emissions.

[3] While this EIR/EIS was being prepared, FRA adopted new NEPA compliance regulations (23 C.F.R. 771). Those regulations only apply to actions initiated after November 28, 2018. See 23 C.F.R. 771.109(a)(4). Because this EIR/EIS was initiated prior to that date, it remains subject to FRA's Environmental Procedures rather than the Part 771 regulations.

[4] The Council on Environmental Quality issued new regulations on July 14, 2020, effective September 14, 2020, updating the NEPA implementing procedures at 40 C.F.R. Parts 1500-1508. However, this project initiated NEPA before the effective date and is not subject to the new regulations, relying on the 1978 regulations as they existed prior to September 14, 2020. All subsequent citations to Council on Environmental Quality regulations in this environmental document refer to the 1978 regulations, pursuant to 40 C.F.R. 1506.13 (2020) and the preamble at 85 Fed. Reg. 43340.

and $PM_{2.5}$), CO, NO_2, SO_2, and Pb. NAAQS are divided into primary and secondary standards; the former are set to protect human health with an adequate margin of safety, the latter to protect environmental values, such as plant and animal life. Table 3.3-1 summarizes NAAQS currently in effect for each criteria pollutant. The table also provides California Ambient Air Quality Standards (CAAQS) (discussed in Section 3.3.2.2, State) for reference.

The CAA requires that a state implementation plan (SIP) be prepared for local areas that do not meet the NAAQS, referred to as nonattainment areas. The SIP must include pollution control measures that demonstrate how the standards will be met by the dates specified in the CAA. Section 176(c) of the CAA provides that federal agencies cannot engage, support, or provide financial assistance for licensing, permitting, or approving any project unless the project conforms to the applicable SIP. This process is known as "conformity" and is discussed in the following section. The goal of the SIP is to eliminate or reduce the severity and number of violations of the NAAQS and to achieve expeditious attainment of the standards.

Conformity Rule

Pursuant to CAA Section 176(c) requirements, USEPA enacted the federal General Conformity[5] Rule (40 Code of Federal Regulations [C.F.R.] Parts 5, 51, and 93) in 1993. The purpose of the General Conformity Rule is to prevent federal actions from generating emissions that interfere with state and local agencies' SIPs and emission-reduction strategies to attain the NAAQS.

Pursuant to 23 U.S.C. 327 and a Memorandum of Understanding (MOU) executed by the FRA and the State of California on July 23, 2019, FRA assigned its federal environmental review responsibilities under the NEPA and related statutes to the Authority under a federal program commonly known as NEPA Assignment. Accordingly, the Authority is now the NEPA lead agency. Consistent with 23 U.S.C. 327 and the July 23, 2019 NEPA Assignment MOU, FRA retains its obligations to make general conformity determinations under the CAA. The Authority and FRA have agreed to collaborate on the development of general conformity determinations. As part of this collaboration, the Authority has developed and provided to FRA a Draft General Conformity Determination and supporting information, as well as the Authority's proposed approach for achieving general conformity. Because the analysis used for the Final EIR/EIS also generated the information necessary for the Draft General Conformity Determination, specific analysis may be incorporated by reference in the General Conformity Determination. FRA will make the ultimate general conformity determination for this project.

Table 3.3-1 State and Federal Ambient Air Quality Standards

Criteria Pollutant	Averaging Time	California Standards	National Standards[1]	
			Primary	Secondary
Ozone	1-hour	0.09 ppm	None[2]	None[2]
	8–hour	0.070 ppm	0.070 ppm	0.070 ppm
Particulate matter (PM_{10})	24-hour	50 μg/m³	150 μg/m³	150 μg/m³
	Annual mean	20 μg/m³	None	None
Fine particulate matter ($PM_{2.5}$)	24-hour	None	35 μg/m³	35 μg/m³
	Annual mean	12 μg/m³	12.0 μg/m³	15.0 μg/m³
Carbon monoxide	8-hour	9.0 ppm	9 ppm	None
	1-hour	20 ppm	35 ppm	None
	8-hour (Lake Tahoe)	6 ppm	None	None
Nitrogen dioxide	Annual mean	0.030 ppm	0.053 ppm	0.053 ppm

[5] Note that "Transportation Conformity" is an analytical process required for all federally funded roadway transportation projects, but it does not apply to the project.

Criteria Pollutant	Averaging Time	California Standards	National Standards[1]	
			Primary	Secondary
	1-hour	0.18 ppm	0.100 ppm	None
Sulfur dioxide	Annual mean	None	0.030 ppm[3]	None
	24-hour	0.04 ppm	0.14 ppm[3]	None
	3-hour	None	None	0.5 ppm
	1-hour	0.25 ppm	0.075 ppm	None
Lead	30-day average	1.5 μg/m^3	None	None
	Calendar quarter	None	1.5 μg/m^3	1.5 μg/m^3
	3-month average	None	0.15 μg/m^3	0.15 μg/m^3
Sulfates	24-hour	25 μg/m^3	None	None
Visibility-reducing particles	8-hour	–[4]	None	None
Hydrogen sulfide	1-hour	0.03 ppm	None	None
Vinyl chloride	24-hour	0.01 ppm	None	None

Source: CARB 2016

[1] National standards are divided into primary and secondary standards. Primary standards are intended to protect public health, whereas secondary standards are intended to protect public welfare and the environment.

[2] The federal 1-hour standard of 12 parts per 100 million was in effect from 1979 through June 15, 2005. The revoked standard is referenced because it was employed for such a long period and is a benchmark for state implementation plans.

[3] The annual and 24-hour NAAQS for SO_2 apply only for 1 year after designation of the new 1-hour standard to those areas that were previously nonattainment for 24-hour and annual NAAQS.

[4] CAAQS for visibility-reducing particles is defined by an extinction coefficient of 0.23 per kilometer – visibility of 10 miles or more because of particles when relative humidity is less than 70 percent.

μg/m^3 = micrograms per cubic meter
ppm = parts per million
CAAQS = California ambient air quality standards
NAAQS = national ambient air quality standards

The General Conformity Rule applies to all federal actions in areas that do not meet the NAAQS that are not exempt from the General Conformity Rule, covered by a Presumed-to-Conform approved list,[6] or do not meet *de minimis* emission levels established in the General Conformity Rule (75 *Federal Register* [Fed. Reg.] 17255). The General Conformity Rule applies only to direct and indirect emissions generated by a federal action that are subject to New Source Review for which a federal permitting agency has directly caused or initiated, has continued program responsibility for, or can practically control. The rule does not include stationary industrial sources requiring air quality permits from local air pollution control agencies. Because the San Jose to Merced Project Section likely will require and/or receive one or more federal approvals or future federal construction funding, the Authority anticipates FRA will issue a General Conformity Determination in accordance with the implementing regulations of Section 176 of the CAA.

A conformity determination under the General Conformity Rule is required for the project alternatives if the Authority determines that all of the following criteria apply:

- The action will occur in a nonattainment or maintenance area.
- One or more specific exemptions do not apply to the action.
- The action is not included in the federal agency's "presumed to conform" list.
- The emissions from the proposed action are not within the approved emissions budget for an applicable facility.

[6] Category of activities designated by a federal agency as having emissions below *de minimis* levels or otherwise do not interfere with the applicable SIP or the attainment and maintenance of the NAAQS.

- The total direct and indirect emissions of a pollutant (or its precursors) are at or above the *de minimis* levels established in the General Conformity Rule (75 Fed. Reg. 17255).

The evaluation of whether total direct and indirect emissions exceed the requirements of 40 C.F.R. Section 93.158(c) is performed by comparing total annual emissions to the applicable *de minimis* emissions level listed in 40 C.F.R. Section 93.153(b). If the evaluation indicates that emissions are in excess of any of the General Conformity *de minimis* thresholds, the Authority must perform a conformity determination.

Mobile Source Air Toxics and Hazardous Air Pollutants

While NAAQS or CAAQS do not exist for MSATs or hazardous air pollutants (HAP), USEPA regulates these pollutants through rules and emission control programs. In February 2007, USEPA finalized a rule (Control of Hazardous Air Pollutants from Mobile Sources, February 9, 2007) to limit the benzene content of gasoline and reduce toxic emissions from passenger vehicles and gas cans. USEPA is also developing programs that would provide additional benefits (further controls) for small off-road gasoline engines, diesel locomotives, and marine engines. These regulatory controls will complement existing USEPA programs that reduce risk in local communities, including the Clean School Bus USA, the Voluntary Diesel Retrofit Program, Best Workplaces for Commuters, and the National Clean Diesel Campaign.

Federal Greenhouse Gas Regulations and Guidance

In *Massachusetts v. U.S. Environmental Protection Agency, et al.*, 549 U.S. 497 (2007), the United States Supreme Court ruled that GHGs fit within the CAA's definition of air pollutants and that USEPA has the authority to regulate GHGs. Pursuant to its authority under the CAA, USEPA published a rule on October 30, 2009, that requires mandatory reporting of GHG emissions from facilities that emit 25,000 metric tons or more per year of GHG emissions. The final rule covers the GHGs CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride (SF_6), and other fluorinated gases, including nitrogen trifluoride and hydrofluorinated ethers. While the mandatory reporting rule is not a transportation-related regulation, the reporting methodology developed as part of the regulation is helpful in identifying potential GHG emissions from transportation projects.

Federal GHG regulation has continued to evolve since the initial Supreme Court ruling in 2007. Key legislation and regulatory orders applicable to the project alternatives are briefly described in the following list. Refer to the Air Quality and Greenhouse Gases Technical Report (Volume 2, Appendix 3.3-A) for additional detail.

- **U.S. Presidential Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance* (October 5, 2009)**—Requires federal agencies to set a 2020 GHG emission-reduction target, increase energy efficiency, conserve resources, support sustainable communities, and leverage federal purchasing power to promote environmentally responsible products and technologies.
- ***Final Endangerment and Cause or Contribute Findings for Greenhouse Gases* (December 7, 2009)**—States that current and projected concentrations of the six key well-mixed GHGs in the atmosphere—CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, and SF_6—threaten the public health and welfare of current and future generations.
- **Updated Corporate Average Fuel Economy Standards (October 15, 2012)**—Requires substantial improvements in fuel economy and reductions in GHG emissions for all light-duty vehicles sold in the U.S. The updated standards apply to new passenger cars, light-duty trucks, and medium-duty passenger vehicles, covering model years 2017 through 2025, and are equivalent to 54.5 miles per gallon. On August 2, 2018, the NHTSA and USEPA proposed to amend the fuel efficiency standards for passenger cars and light trucks and establish new standards covering model years 2021 through 2026 by maintaining the current model year 2020 standards through 2026 (SAFE Vehicles Rule). On September 19, 2019, USEPA and NHTSA issued a final action on the One National Program Rule, which is considered Part One of the SAFE Vehicles Rule and a precursor to the proposed fuel

efficiency standards. The One National Program Rule enables USEPA/NHTSA to provide nationwide uniform fuel economy and GHG vehicle standards, specifically by 1) clarifying that federal law preempts state and local tailpipe GHG standards, 2) affirming NHTSA's statutory authority to set nationally applicable fuel economy standards, and 3) withdrawing California's CAA preemption waiver to set state-specific standards. USEPA and NHTSA published their decisions to withdraw California's waiver and finalize regulatory text related to the preemption on September 27, 2019 (84 Fed. Reg. 51310). California, 22 other states, the District of Columbia, and two cities filed suit against Part One of the SAFE Vehicles Rule on September 20, 2019 *(California et al. v. United States Department of Transportation et al.*, 1:19-cv-02826, U.S. District Court for the District of Columbia). On October 28, 2019, the Union of Concerned Scientists, Environmental Defense Fund, and other groups filed a protective petition for review after the federal government sought to transfer the suit to the D.C. Circuit (*Union of Concerned Scientists v. National Highway Traffic Safety Administration*). The lawsuit filed by California and others is stayed pending resolution of the petition.

USEPA and NHTSA published final rules to amend and establish national CO_2 and fuel economy standards on April 30, 2020 (Part Two of the SAFE Vehicles Rule) (85 Fed. Reg. 24174). The revised rule changes the national fuel economy standards for light duty vehicles from 50.4 miles per gallon to 40.5 miles per gallon in future years. California, 22 other states, and the District of Columbia filed a petition for review of the final rule on May 27, 2020.

On January 20, 2021, President Joseph Biden issued an executive order directing the USEPA and NHTSA to review the SAFE Vehicles Rule and propose a new rule suspending, revising, or rescinding it. On April 22, 2021, NHTSA issued a notice of proposed rulemaking to repeal the SAFE Vehicles Rule (49 C.F.R. Parts 531 and 533). On August 10, 2021, NHTSA issued a notice of proposed rulemaking to amend the CAFÉ standards set in 2020 for passenger cars and light trucks manufactured in model years 2024-2026 so that standards would increase in stringency at a rate of 8% per year rather than the 1.5% per year set previously.

- ***Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles* (September 15, 2011, and August 16, 2016)**—Phase I of the standards applies to model years 2014 through 2018 and is tailored to each of three regulatory categories of heavy-duty vehicles—combination tractors, heavy-duty pickup trucks and vans, and vocational vehicles. Phase 2 of the standards apply to model years 2019 through 2027 medium- and heavy-duty vehicles.
- ***Guidance on Considering Climate Change in NEPA Reviews and Conducting Programmatic NEPA Reviews* (August 1, 2016 and June 26, 2019)**—The White House CEQ released final guidance regarding the consideration of GHG in National Environmental Policy Act (NEPA) documents for federal actions in August 2016 (CEQ 2016). On April 25, 2017, CEQ withdrew the final guidance pursuant to U.S. Presidential Executive Order 13783, but noted "the withdrawal of the guidance does not change any law, regulation, or other legally binding requirement (82 Fed. Reg. 16576)." The CEQ released new draft guidance on June 26, 2019, which, if finalized, would replace the withdrawn August 2016 guidance. The June 2019 draft guidance requires federal agencies to analyze the direct, indirect, and cumulative impacts of a proposed action's GHG emissions, as well as consider the impacts of climate change on the project.

3.3.2.2 State

California Clean Air Act and California Ambient Air Quality Standards

In 1988, the state legislature adopted the California Clean Air Act, which established a statewide air pollution control program. The act is administered by the California Air Resources Board (CARB) at the state level and by local air quality management districts at the regional level. The air districts are required to develop plans and control programs for attaining the CAAQS by the earliest practicable date. The CAAQS are generally more stringent than NAAQS and incorporate

additional standards for sulfates, hydrogen sulfide, visibility-reducing particles, and vinyl chloride. CAAQS and NAAQS are listed together in Table 3.3-1.

The CARB is responsible for implementation of the California Clean Air Act, meeting state requirements of the federal CAA, and establishing the CAAQS. The CARB is also responsible for setting emission standards for vehicles sold in California and for other emission sources, such as consumer products and certain off-road equipment. The CARB also establishes passenger vehicle fuel specifications.

Mobile Source Air Toxics and Toxic Air Contaminates

California regulates TACs (equivalent to the federal HAPs) primarily through the Toxic Air Contaminant Identification and Control Act (Tanner Act) and the Air Toxics "Hot Spots" Information and Assessment Act of 1987 (Hot Spots Act). The Tanner Act created California's program to reduce exposure to air toxics. The Hot Spots Act supplements the Tanner Act by requiring a statewide air toxics inventory, notification of people exposed to a significant health risk, and stationary source plans to reduce these risks.

Diesel Particulate Matter Control Measures

In August 1998, the CARB identified DPM from diesel-fueled engines as a TAC. In September 2000, the CARB approved a comprehensive Diesel Risk Reduction Plan to reduce DPM from new and existing diesel-fueled engines and vehicles. The CARB has also adopted regulations to reduce emissions from both on-road and off-road heavy-duty diesel vehicles (e.g., equipment used in construction). These regulations, known as Airborne Toxic Control Measures, reduce the idling of school buses and other commercial vehicles, control DPM, and limit the emissions of ocean-going vessels in California waters. The regulations also include measures to control emissions of air toxics from stationary sources. The California Toxics Inventory, developed by interpolating from CARB estimates of total organic gases and PM, provides emissions estimates by stationary, area-wide, on-road mobile, off-road mobile, and natural sources (CARB 2015).

Asbestos Control Measures

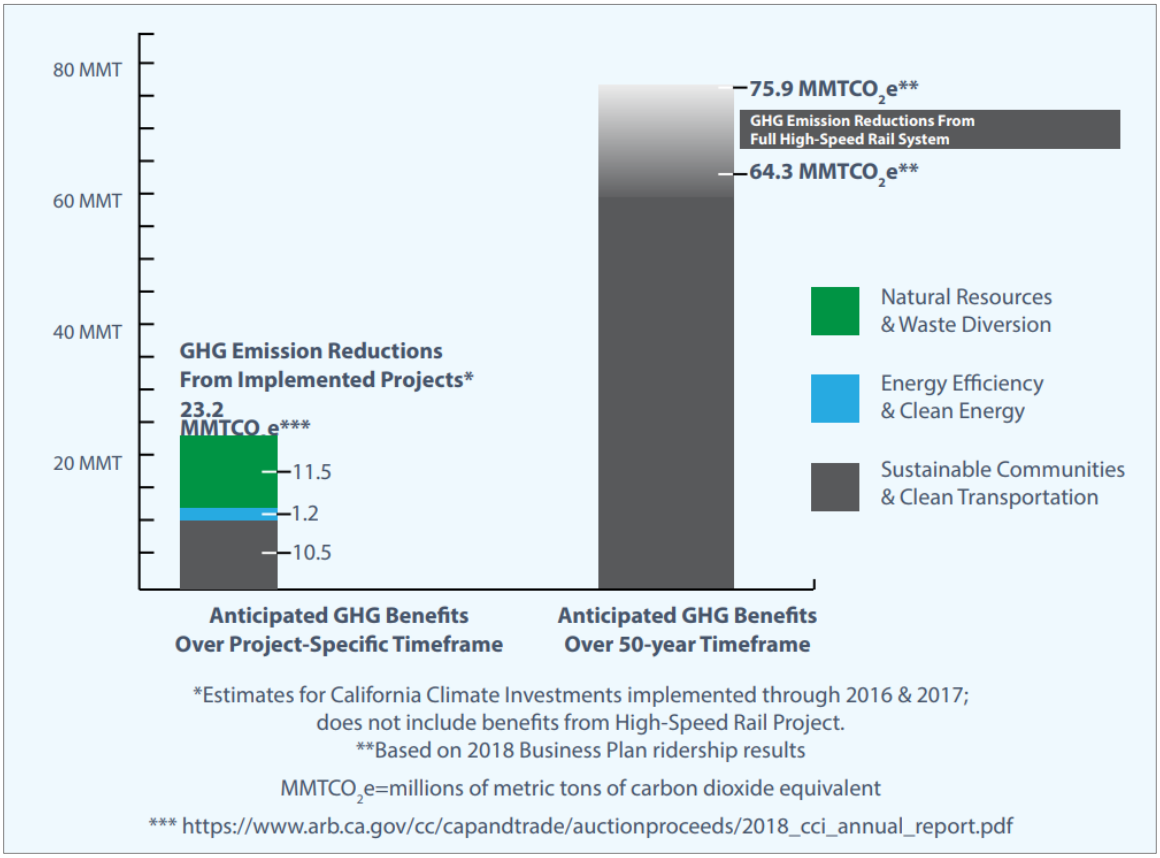
The CARB has adopted two airborne toxic control measures for controlling naturally occurring asbestos (NOA): the *Asbestos Airborne Toxic Control Measure for Surfacing Applications* and the *Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, and Surface Mining Operations*. While USEPA is responsible for enforcing regulations relating to asbestos renovations and demolitions, it can delegate this authority to state and local agencies. The CARB and local air districts have been delegated authority to enforce the Federal National Emission Standards for Hazardous Air Pollutants regulations for asbestos.

California Greenhouse Gas Regulations and Guidance

California has taken proactive steps to reduce GHG emissions. This section briefly describes key legislation and regulatory orders applicable to the project alternatives. Refer to the Air Quality and Greenhouse Gases Technical Report (Volume 2, Appendix 3.3-A) for additional detail.

- **Assembly Bill (AB) 1493 (2002)**—Requires CARB to develop and implement regulations to reduce automobile and light-truck GHG emissions, beginning with the model year 2009.
- **California EO S-3-05 (2005)**—Establishes goals to reduce California's GHG emissions to 2000 levels by 2010, 1990 levels by 2020, and 80 percent below the 1990 levels by 2050.
- **AB 32 (2006)**—Requires the CARB to implement emission limits, regulations, and other feasible and cost-effective measures such that statewide GHG emissions are reduced to 1990 levels by 2020. Pursuant to AB 32, CARB adopted the Climate Change Scoping Plan (AB 32 Scoping Plan) in December 2008, which outlines measures for meeting the 2020 GHG emissions reduction limit. The first update to the AB 32 Scoping Plan was published in 2014. The scoping plan was subsequently updated as part of the California's 2017 Scoping Plan, which was adopted to address Senate Bill (SB) 32.

- **EO S-01-07 (2007)**—Mandates that a statewide goal be established to reduce the carbon intensity of California's transportation fuels by at least 10 percent by 2020, and that a low-carbon fuel standard for transportation fuels be established in California.
- **SB 375 (2008)**—Requires the state's 18 metropolitan planning organizations to incorporate a sustainable communities strategy in their regional transportation plans (RTP) to attain the GHG emissions reduction targets set by CARB for 2020 and 2035.
- **SB 32 and AB 197 (2016)**—Requires the CARB to reduce statewide GHG emissions to at least 40 percent below the 1990 level by 2030. On December 14, 2017, the CARB adopted the 2017 Climate Change Scoping Plan, the strategy for achieving California's 2030 GHG emissions target. The 2030 midterm target helps to frame the suite of policy measures, regulations, planning efforts, and investments in clean technologies and infrastructure needed to continue driving down emissions. The plan is intended to drive the state toward more electric vehicles; cleaner electricity to fuel those cars; denser, more walkable communities with more efficient buildings; and less-polluting agriculture.
- **SB 100 (2018)**—Extends the state's Renewables Portfolio Standard to 50 percent by December 31, 2026; 60 percent by December 31, 2030; and 100 percent by December 31, 2045.
- **EO B-55-18 (2018)**—Establishes goal to achieve carbon neutrality by 2045.
- **Innovative Clean Transit Regulation (2018)—**Requires public transit agencies to gradually transition to 100 percent zero-emission bus fleets by 2040. Figure 3.3-1 illustrates the estimated aggregate reductions in GHG emissions that would result from the HSR system over a 50-year timeframe.


80 MMT
60 MMT
40 MMT
20 MMT
GHG Emission Reductions From Implemented Projects*
23.2 MMTCO2e***
11.5
1.2
10.5
75.9 MMTCO2e**
GHG Emission Reductions From Full High-Speed Rail System
64.3 MMTCO2e**
Natural Resources & Waste Diversion
Energy Efficiency & Clean Energy
Sustainable Communities & Clean Transportation
Anticipated GHG Benefits Over Project-Specific Timeframe
Anticipated GHG Benefits Over 50-year Timeframe
*Estimates for California Climate Investments implemented through 2016 & 2017; does not include benefits from High-Speed Rail Project.
**Based on 2018 Business Plan ridership results
MMTCO2e=millions of metric tons of carbon dioxide equivalent
*** https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/2018_cci_annual_report.pdf

Sources: Authority 2018

Figure 3.3-1 Aggregate GHG Emissions Reductions That Would Result from the California High-Speed Rail Project

3.3.2.3 Regional and Local

This section describes the three air management districts and other regional and local planning agencies in the RSA and provides an overview of regional air quality and climate action plans relevant to the analysis of air quality and GHGs. Volume 2, Appendix 2-J provides a complete list of regional and local plans and policies relevant to air quality and GHGs considered in the preparation of this analysis.

Air Quality Management Districts

The project crosses three air basins—San Francisco Bay Area Air Basin (SFBAAB), North Central Coast Air Basin (NCCAB), and SJVAB—and falls under the jurisdiction of three air districts—Bay Area Air Quality Management District (BAAQMD), MBARD, and San Joaquin Valley Air Pollution Control District (SJVAPCD). The BAAQMD, MBARD, and SJVAPCD have the following responsibilities:

- Implementing air quality regulations, including developing plans and control measures for stationary sources of air pollution to meet the NAAQS and CAAQS.
- Implementing permit programs for the construction, modification, and operation of sources of air pollution.
- Coordinating with local transportation planning agencies on mobile emissions inventory development, transportation control measure development and implementation, and transportation conformity.
- Enforcing air pollution statutes and regulations governing stationary sources. With CARB oversight, the air districts also administer local regulations.

All three air districts have adopted advisory emission thresholds to assist California Environmental Quality Act (CEQA) lead agencies in determining the level of significance of a project's emissions. They have also adopted air quality plans, which are discussed further in this section, to improve air quality, protect public health, and protect the climate. Please refer to the Air Quality and Greenhouse Gases Technical Report (Volume 2, Appendix 3.3-A) for a summary of air district rules applicable to the project.

Metropolitan Planning Organizations

The project crosses three metropolitan planning organizations—Metropolitan Transportation Commission (MTC), Association of Monterey Bay Area Governments, and Merced County Association of Governments (MCAG)—and one regional transportation planning agency, Council of San Benito County Governments. The metropolitan planning organizations and regional transportation planning agency are responsible for transportation planning within their local jurisdictions. MTC is the federally designated metropolitan planning organization for the San Francisco Bay Area (Bay Area), and is supported by the Association of Bay Area Governments, which is the Bay Area regional planning body. The Council of San Benito County Governments and MCAG are the transportation agencies for San Benito and Merced Counties, respectively.

Air Quality Plans

State Implementation Plan

As discussed in Section 3.3.2.1, Federal, the CAA requires areas with unhealthy levels of O_3, inhalable PM, CO, NO_2, and SO_2 to develop SIPs that describe how an area will attain NAAQS. SIPs are not single documents. They are a compilation of new and previously submitted plans, programs (such as monitoring, modeling, or permitting), district rules, state regulations, and federal controls. Many of California's SIPs rely on the same core set of control strategies,

including emission standards for cars and heavy trucks, fuel regulations, and limits on emissions from consumer products. Section 3.3.5.1, Air Quality, describes SIPs relevant to the RSA.

Transportation Plans and Programs

An RTP is a long-range plan that includes both long- and short-range strategies and actions that lead to the development of an integrated multimodal transportation system to address future transportation demand. RTPs address a region's growth, transportation goals, objectives, and policies for the next 25 years and identify the actions necessary to achieve those goals. Transportation improvement programs provide a comprehensive listing of all surface transportation projects that are to receive federal funding, are subject to a federally required action, or are considered regionally significant for air quality conformity purposes. The relevant RTPs and transportation improvement programs in the RSA are described in detail in the Air Quality and Greenhouse Gases Technical Report (Volume 2, Appendix 3.3-A).

Climate Action Plans

Several cities in the RSA have adopted or are in the process of developing climate action plans, GHG reduction plans, or equivalent documents aimed at reducing local GHG emissions. Jurisdictions with adopted or in development climate action plans or GHG reduction plans for either municipal operations, community activities, or both include Santa Clara, San Jose, Gilroy, Morgan Hill, and Santa Clara County. These plans all call for reductions in GHG emissions below current levels and actions to reduce VMT and associated transportation emissions. All plans include increased transit service as a key strategy in reducing local GHG emissions.

3.3.3 Consistency with Plans and Laws

As indicated in Section 3.1.6.3, Consistency with Plans and Laws, the CEQA and CEQ regulations require a discussion of inconsistencies or conflicts between a proposed undertaking and federal, state, regional, or local plans and laws. As such, this Final EIR/EIS describes inconsistency of the project alternatives with federal, state, regional, and local plans and laws to provide planning context.

Several federal and state laws and implementing regulations listed in Section 3.3.2.1, Federal, and Section 3.3.2.2, State, protect the air quality and public health at a regional and local level and aim to curb GHG emissions and the effects of global climate change. The federal and state requirements considered in this analysis are summarized as follows:

- Federal and state laws and regulations that set standards for the ambient air quality in air basins and establish thresholds of significance for air basins in the state to conform to the required standards.
- State laws and executive orders that establish GHG reduction targets to minimize global climate change effects, and that require reductions in GHG emissions from on-road vehicles. State plans approved by the CARB and prepared by the BAAQMD, MBARD, and SJVAPCD outline strategies for nonattainment areas to attain the air quality standards.

The Authority, as the lead agency proposing to construct and operate the HSR system, is required to comply with all federal and state laws and regulations and to secure all applicable federal and state permits prior to initiating construction on the selected alternative. Therefore, there would be no inconsistencies between the project alternatives and these federal and state laws and regulations. The project, including the San Jose to Central Valley Wye Project Extent, is consistent with state efforts to reduce GHG emissions, and is a central component of the state's strategy for reducing GHG emissions from the transportation sector in the 2017 Scoping Plan Update.

The Authority is a state agency and therefore is not required to comply with local land use and zoning regulations; however, it has endeavored to design and construct the HSR system so that it is compatible with land use and zoning regulations. The CEQA and CEQ regulations require the discussion of inconsistencies or conflicts between a proposed undertaking and regional or local plans and laws.

The Authority reviewed 15 plans and 85 policies. Volume 2, Appendix 2-J, Regional and Local Plans and Policies, presents the plans and policies by resource. The project alternatives are consistent with 84 policies and inconsistent with 1 policy. Volume 2, Appendix 2-K, Policy Consistency Analysis, further details the inconsistencies between the project and regional and local plans and policies.

The project alternatives would be inconsistent with certain provisions of the *Plan Bay Area 2040* (Association of Bay Area Governments and MTC 2017)—Plan Bay Area's Target #3. This target requires a 10 percent reduction in health impacts associated with adverse air quality. During construction, all project alternatives could result in new temporary violations of the NAAQS and CAAQS, which have been established to protect public health. However, as described in Section 3.3.7, Mitigation Measures, the Authority has committed to offsetting all construction emissions in excess of BAAQMD and federal thresholds through AQ-MM#3. Furthermore, project operations would lower air pollution after construction.

3.3.4 Methods for Evaluating Impacts

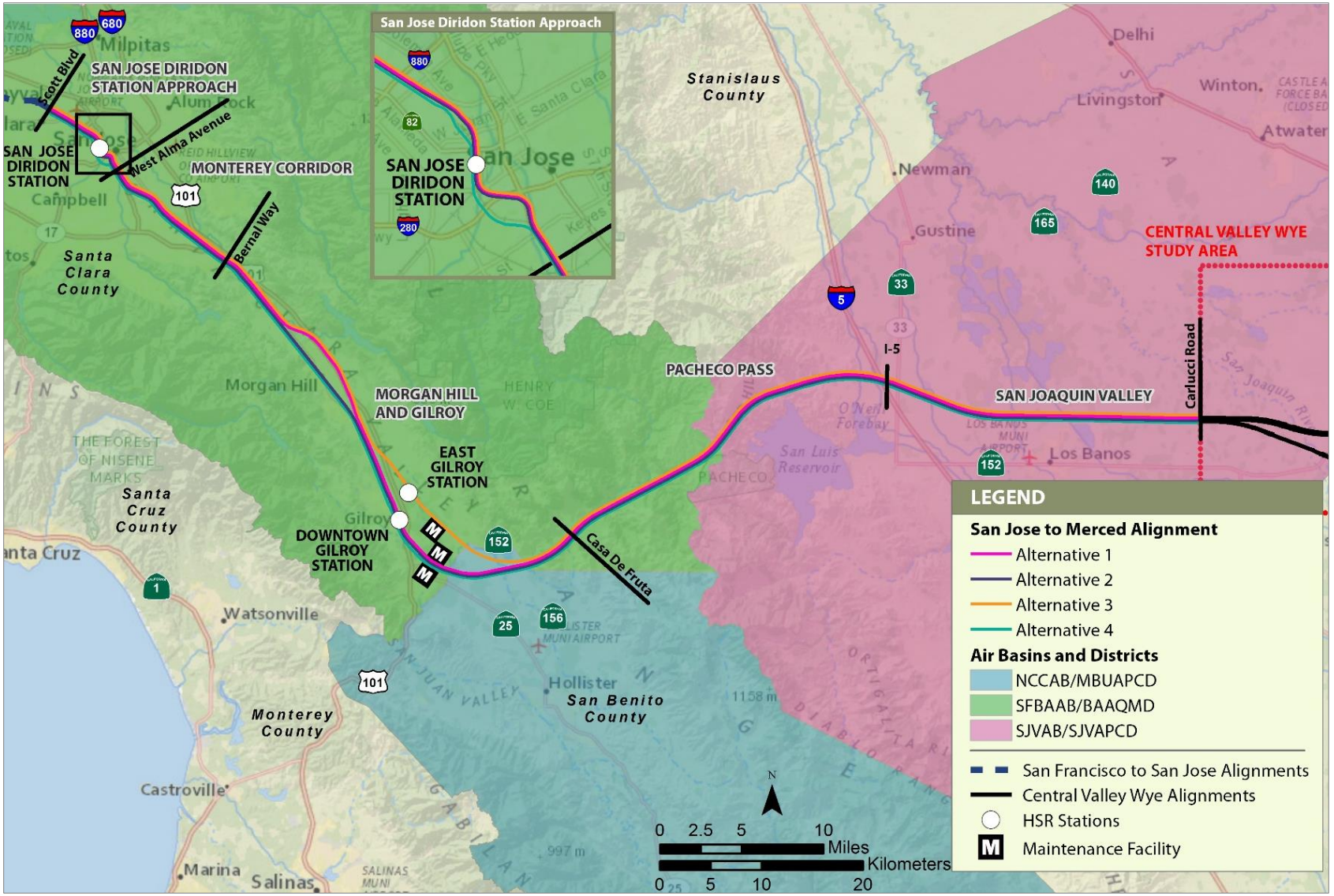
The evaluation of impacts on air quality and GHGs is a requirement of NEPA and CEQA. The following sections summarize the RSAs and the methods used to analyze air quality and GHGs.

3.3.4.1 Definition of Resource Study Area

As defined in Section 3.1, Introduction, RSAs are the geographic boundaries in which the environmental investigations specific to each resource topic were conducted. The RSA for air quality and GHGs encompasses the areas directly and indirectly affected by project construction and operations. The RSAs for air quality and GHGs are distinct because of the nature of criteria pollutants and GHGs mixing into the atmosphere. Three geographic scales define the RSAs:

- Local—The footprint during construction for each project alternative plus areas within 1,000 feet of the temporary features of the project footprint (for localized health risk impacts during construction only).
- Region—The affected air basins (SFBAAB, NCCAB, and SJVAB) for regional impacts during construction and operations.
- State—The entire state with respect to ambient air quality standards during operations. The RSA for impacts on GHGs also includes the entire state and global atmosphere (during construction and operations), the areas for each RSA. Figure 3.3-2 illustrates the regional air quality RSA for the project, including the SFBAAB, and the project alternatives.

Table 3.3-2 describes the RSAs and includes a general definition and a boundary description for each RSA for the project.



Sources: Authority 2019a; CARB 2012

Figure 3.3-2 Resource Study Area Air Basins and Air Districts

Table 3.3-2 Definition of Air Quality and Greenhouse Gases Resource Study Areas

Type	Boundary Definition
Air Quality	
Construction	**Local:** Localized air quality impacts from construction, such as health effects associated with certain criteria pollutants and DPM emissions, would occur in areas within 1,000 feet of the project footprint and staging areas.
	Regional: Regional air quality impacts from construction, such as health effects from increased O_3 and secondary PM formation, could occur in the SFBAAB, NCCAB, and SJVAB.
Operations	**Regional and State:** The air quality RSA associated with operations of the project is the affected air basins—SFBAAB, NCCAB, SJVAB—and the entire state. The project could affect on-road emissions throughout the three air basins and state and aircraft operations regionally and statewide. Emissions from power plants would occur at power facilities throughout the state. Thus, the resulting change in emissions from these sources from project operations could affect regional and statewide air quality.
Greenhouse Gases	
Construction and operations	**State:** The RSA associated with global climate change is the entire state for both construction and operations. GHGs, once emitted, are circulated into the atmosphere on a global scale, and the resulting impacts of climate change occur on a global scale as well. California, through AB 32, SB 32, and other approaches, has chosen to reduce its statewide GHG emissions. Thus, GHG emissions from project construction equipment, power plants, and changes in on-road and aircraft operations, could affect statewide climate change.

AB = Assembly Bill
DPM = diesel particulate matter
GHG = greenhouse gas
NCCAB = North Central Coast Air Basin
O_3 = ozone
PM = particulate matter
RSA = resource study area
SB = Senate Bill
SFBAAB = San Francisco Bay Area Air Basin
SJVAB = San Joaquin Valley Air Basin

3.3.4.2 Impact Avoidance and Minimization Features

IAMFs are project features that are considered to be part of the project and are included as applicable in each of the alternatives for purposes of the environmental impact analysis. The full text of the IAMFs that are applicable to the project is provided in Volume 2, Appendix 2-E, Project Impact Avoidance and Minimization Features. The following IAMFs are applicable to the air quality and GHG analysis:

- AQ-IAMF#1: Fugitive Dust Emissions
- AQ-IAMF#2: Selection of Coatings
- AQ-IAMF#3: Renewable Diesel
- AQ-IAMF#4: Reduce Criteria Exhaust Emissions from Construction Equipment
- AQ-IAMF#5: Reduce Criteria Exhaust Emissions from On-Road Construction Equipment
- AQ-IAMF#6: Reduce the Potential Impact of Concrete Batch Plants
- GEO-IAMF#5: Hazardous Minerals
- HMW-IAMF#5: Demolition Plans
- HMW-IAMF#10: Hazardous Materials Plans

This environmental impact analysis considers these IAMFs as part of the project design. Within Section 3.3.6, Environmental Consequences, each impact narrative describes how these project features are applicable and, where appropriate, effective at avoiding or minimizing potential impacts to less than significant under CEQA.

3.3.4.3 Methods for Impact Analysis

Overview of Impact Analysis

This section describes the sources and methods the Authority used to analyze potential project impacts on air quality and climate change. These methods apply to both NEPA and CEQA analyses unless otherwise indicated. Refer to Section 3.1.6.4, Methods for Evaluating Impacts, for a description of the general framework for evaluating impacts under NEPA and CEQA. Project inconsistencies and conflicts with regional and local plans and policies that regulate air quality and climate change (Volume 2, Appendix 2-K, Policy Consistency Analysis) also were considered in this analysis.

Methods Used to Analyze Impacts

Construction Impacts

- Mass Emissions Modeling
- Health Risk Assessment
- Other Localized Effects
- Asbestos, Lead-based Paint, Valley Fever, and Odors

Operations Impacts

- Mass Emissions Modeling
- Carbon Monoxide Hotspots
- Particulate Matter Hotspots
- Mobile Source Air Toxics
- Operational Health Risk Assessment
- Odors

As discussed in Section 3.3.1, Introduction, the impact analysis focuses on three types of air pollutants that are of greatest concern for the project—criteria pollutants, TACs, and GHGs. The Authority assessed and quantified the impacts of these pollutants generated by construction and operations of the project alternatives using standard and accepted software tools, techniques, and emission factors. Emissions and impacts under all four project alternatives are analyzed at an equal level of detail. This section summarizes the methods used to analyze impacts. The Air Quality and Greenhouse Gases Technical Report (Volume 2, Appendix 3.3-A) provides additional detail on the analysis, including specific modeling assumptions and outputs.

Construction Impacts

Mass Emissions Modeling

Project construction would generate emissions of VOC, NO_X, CO, sulfur oxides (SO_X), PM_{10}, $PM_{2.5}$, CO_2, CH_4, and N_2O that could result in short-term air quality and GHG impacts. Emissions would originate from off-road equipment exhaust, employee and haul truck vehicle exhaust (on-road vehicles), site grading and earth movement, onsite concrete batching, demolition, paving, architectural coating, electricity consumption, and helicopters (for reconductoring work). These emissions would be temporary (i.e., limited to the construction period) and would cease when construction activities are complete.

The Authority estimated combustion exhaust, fugitive dust (PM_{10} and $PM_{2.5}$), and fugitive off-gassing (VOCs) using a combination of emission factors and methods from the California Emissions Estimator Model (CalEEMod), version 2016.3.2; CARB's EMFAC2017 model;[7] and USEPA's AP-42 Compilation of Air Pollutant Emission Factors based on project-specific construction data (e.g., schedule, equipment, on-site and off-site truck volumes) provided by the project engineering team (Scholz 2018). All major design components of the project (viaduct, embankment, at grade, trench, tunnel, and cut and fill) were quantitatively analyzed and included in the emissions modeling. The analysis also considered emissions generated by heavy-duty trucks used to haul ballast and subballast from regional quarries to the project, as well as emissions from the reconductoring of existing Pacific Gas and Electric Company (PG&E) of the Spring to Llagas and Green Valley to Llagas power lines. All ballast would be hauled from quarries located within one of the three project air basins (SFBAAB, NCCAB, and SJVAB). The PG&E reconductoring work would occur within the SFBAAB.

[7] CARB's (2019a, 2020a) SAFE Vehicles Rule adjustment factors were applied to the emission factors for gasoline-powered vehicles.

As discussed in Chapter 2, Alternatives, the Authority has incorporated IAMFs into the project that would avoid or minimize potential impacts on air quality. The construction impact analysis and emissions modeling accounts for emissions benefits achieved by incorporation of AQ-IAMF#1 through AQ-IAMF#6.

Daily and Annual Emissions Estimates

The analysis assumes that project construction would occur over multiple phases between 2022 and 2028. Analysts quantified daily criteria pollutant and GHG emissions generated by construction of each phase using the methods previously described in the Mass Emissions Modeling section. Analysts converted the daily estimates to annual totals based on the detailed construction schedule for each project alternative, and identified maximum daily emissions, based on concurrent construction activity, within the BAAQMD and MBARD, consistent with air district requirements (BAAQMD 2017a; MBUAPCD 2008). The highest daily emissions in each construction year were selected as the peak day for analysis purposes. This approach is conservative and based on available information and, therefore, is not necessarily representative of actual daily emissions that would occur during the construction period.

Emissions by Air District and Basin

The project falls under the jurisdiction of three air districts—BAAQMD, MBARD, and SJVAPCD—all of which have adopted their own distinct local thresholds of significance. To compare emissions to the federal and state thresholds, activities occurring within each air district were quantified and analyzed separately.[8]

Emissions generated by construction in the five subsections in the project extent that would occur exclusively within one air district (e.g., South San Jose) were wholly assigned to that air district. Emissions estimates for subsections and ballast hauling that span more than one air district were apportioned based on the location of construction activity. For example, construction of the Pacheco Pass Subsection would occur in both the BAAQMD and SJVAPCD. Accordingly, the emissions estimates were apportioned to the BAAQMD and SJVAPCD based on the number of rail miles constructed within each air district.

Health Risk Assessment

The Authority conducted an HRA to assess the potential impacts associated with public exposure to DPM and localized $PM_{2.5}$ exhaust. The HRA was conducted using the *Guidance Manual for Preparation of Health Risk Assessments* (California Office of Environmental Health Hazard Assessment [OEHHA] 2015) for the Air Toxics Hot Spots Program and *Health Risk Assessments for Proposed Land Use Projects* developed by the California Air Pollution Control Officers Association in 2009. The HRA was only performed for construction of the HSR facilities (e.g., alignment, stations). The PG&E reconductoring work is not included in the HRA because it would be spread throughout an 11.1-mile corridor and would only occur at individual pole locations on a short-term (i.e., few weeks) and temporary basis.

The HRA consists of three parts: (1) PM emissions inventory (2) air dispersion modeling to evaluate off-site concentrations of PM emissions, and (3) assessment of cancer and noncancer risks associated with predicted concentrations. The following subsections provide a brief description of each component.

Particulate Matter Emissions Inventory

The mass emissions analysis includes PM emissions generated by heavy-duty equipment and vehicle exhaust, as well as fugitive dust from site grading and soil movement. The particulate constituent analyzed in the HRA depends on the emission location and associated air district guidance. The BAAQMD (2017a) guidance considers DPM as the surrogate for total diesel

[8] The CARB acknowledges that air basins, in particular the SJVAB, are both contributors and receptors of pollutant transport throughout the state. While technical documents have been published analyzing the transport relationship among California air basins, quantifying the effects of pollutant transport as a result of project implementation would require detailed projections of future climatic and meteorological conditions. Air districts in the RSA have adopted thresholds and mitigation requirements that are commensurate with expected criteria air pollutant contributions from upwind air basins (CARB 2011).

exhaust, with its guidance requiring that diesel $PM_{2.5}$ emissions serve as the basis for the cancer and noncancer risk calculations in the SFBAAB (Kirk 2016). BAAQMD guidance also indicates that localized $PM_{2.5}$ risks should be evaluated using total $PM_{2.5}$ exhaust emissions (i.e., emissions from both diesel- and gasoline-powered equipment). SJVAPCD (2015a) has adopted slightly different guidance and requires that diesel PM_{10} emissions serve as the basis for the risk calculations in the SJVAB. SJVAPCD has not adopted a localized $PM_{2.5}$ threshold or analysis requirement.

Air Dispersion Modeling

Analysts used USEPA's AERMOD dispersion model to quantify annual average PM concentrations at nearby receptor locations for each subsection. The modeling approach follows, where applicable, the OEHHA and California Air Pollution Control Officers Association methods, but is also consistent with SJVAPCD and BAAQMD methods, as provided in their guidance documents and based on staff consultation (SJVAPCD 2015a; BAAQMD 2012).[9] Analysts used three representative meteorological datasets, which broadly cover the different meteorological conditions in the RSA. Eight types of construction work areas were assumed to characterize construction activities and emissions. Receptor spacing was determined based on air district guidance and varies based on the type of construction (e.g., trench vs. tunnel) and location (e.g., rural vs. urban). Receptor heights were all set to 1.2 meters, consistent with OEHHA (2015) guidance.

Risk Calculations

Consistent with USEPA, CARB, and air district regulatory guidance, the HRA examines cancer and noncancer (chronic)[10] exposure to the surrounding community and uses OEHHA's guidance on risk calculations (OEHHA 2015). Cancer risk is defined as the lifetime probability (chance) of developing cancer from exposure to a carcinogen, typically expressed as the increased chance in 1 million. Noncancer chronic effects are defined as the long-term risk associated with health outcomes other than cancer, typically expressed as a ratio, with a ratio of 1.0 indicating the level at which adverse noncancer effects are likely to occur. Consistent with BAAQMD (2017a) guidance, the analysis also considers noncancer health effects from exposure to total $PM_{2.5}$ exhaust from construction in the SFBAAB.

The risk factors from OEHHA incorporate worst-case, health-protective assumptions. They were established using data from animal and epidemiological exposure studies and represent increased health effects assuming continuous lifetime exposure to a pollutant. Analysts also modeled all receptors with "residential" exposure parameters, assuming exposure to construction-generated pollution would begin during the third trimester of gestation. Defining all receptors as "residential" is conservative because it combines the longest exposure duration (third trimester through end of construction) with the highest age sensitivity factors and exposure frequencies (as defined by OEHHA guidance), yielding a worst-case assessment of potential cancer burden for all other receptor types (e.g., schools). The HRA presented in this section is therefore conservative in that it utilizes these worst-case, health-protective assumptions.

Localized Criteria Pollutant Analysis

Criteria pollutants are classified as either regional or localized pollutants. Regional pollutants can be transported over long distances and affect ambient air quality far from the emissions source. Localized pollutants affect ambient air quality near the emissions source. As discussed in Section 3.3.1, ozone is considered a regional criteria pollutant, whereas CO, NO_2, SO_2, and Pb are localized pollutants. Particulate matter can be both a local and a regional pollutant, depending on its composition. The primary criteria pollutants of concern generated by the project are ozone precursors (VOC and NO_X), NO_2, CO, PM, and SO_2.

Potential health effects induced by regional criteria pollutant emissions generated by the project (ozone precursors and PM) are evaluated using the mass emissions modeling and are discussed

[9] BAAQMD's conservative modeling guidance was followed for the portion of the project that traverses the MBARD.

[10] Note that the OEHHA, CARB, BAAQMD, and SJVAPCD have not identified acute health effects from diesel exhaust. Therefore, acute health effects are not included in this analysis.

further in Section 3.3.6, Environmental Consequences. Localized pollutants (NO_2, CO, PM, and SO_2) generated by a project are deposited and potentially affect populations near the emissions source. Accordingly, analysts conducted a quantitative ambient air quality analysis (AAQA) to assess the potential for construction-generated criteria pollutants to cause new or contribute to existing violations of the NAAQS and CAAQS. As discussed above, the NAAQS and CAAQS are health-protective standards and define the maximum amount of ambient pollution that can be present without harming public health.

The AAQA considers annual, daily, and hourly emissions impacts of all localized criteria pollutants, as applicable based on the established air quality standard. Specifically, the pollutants of concern with established annual standards are NO_2,[11] PM_{10}, and $PM_{2.5}$. The following pollutants of concern have established hourly or daily standards:

- CO (1 hour and 8 hours)
- PM_{10} and $PM_{2.5}$ (24 hours)
- NO_2 (1 hour)
- SO_2 (1 hour and 24 hours)

The Authority modeled off-site concentrations of pollutants using the annual mass emissions inventory and the AERMOD dispersion model. A representative maximum emission scenario for hourly and daily impacts was developed for each of the project's five subsections based on maximum activity levels that could take place concurrently. All major design components of the project (e.g., viaduct, embankment, at grade) were quantitatively analyzed. The combined effect of emissions from geographically proximate construction was also assessed.

Asbestos, Lead-Based Paint, Valley Fever, and Odor Impacts

The Authority used the *San Jose to Merced Project Section Geology, Soils, and Seismicity Technical Report* (Authority 2019b) to determine if NOA occurs within the local RSA. LBP may have been used during construction of existing structures throughout the RSA. The Authority considered whether demolition would occur and whether the project would comply with applicable standards for appropriate disposal. The Valley fever and odor analyses are likewise qualitative and consider the potential for receptors to be exposed to *Coccidioides immitis* (*C. immitis*) fungus spores and nuisance odors.

Operations Impacts

The following discussion identifies the methods and assumptions used for evaluating operations-phase emissions and impacts on air quality and global climate change. The analysis is based on impact assessment in 2029 (initial operation) and 2040 (operations after initial ridership build-up). Because existing background conditions (e.g., background traffic volumes, trip distribution, and vehicle emissions) in 2015 would change over the 25-year project life, the project's air quality operations impacts are evaluated against both existing (2015) conditions and future No Project conditions as they are expected to be in 2029 and 2040 (when the full Phase 1 of the statewide HSR system is in operation). The difference between emissions with the project and without the project represents the net impact of the project.

The Authority calculated criteria pollutant and GHG emissions under two ridership scenarios: a medium ridership scenario of the Silicon Valley to Central Valley line (from San Jose to north of Bakersfield) and a high ridership scenario of the same line. Both scenarios are based on the level

[11] NO_X is both a regional and localized pollutant. Regional effects (i.e., O_3 formation) take place over long distances and time scales and are not analyzed through a localized ambient air quality analysis. Likewise, since VOC is a regional pollutant, it is not addressed in the localized analysis. Rather, O_3 impacts (through NO_X and VOC emissions) are addressed through a comparison of project emissions to the air district and federal *de minimis* thresholds (see Table 3.3-11). Localized effects can occur from the conversion of NO_X to NO_2, and these effects are assessed through the localized NO_2 analysis to confirm emissions would not exceed the CAAQS or NAAQS.

of ridership as presented in the Authority's *2016 Business Plan* (Authority 2016).[12] The tables in the impact analysis, therefore, present two values for operations emissions for each pollutant corresponding to these two scenarios.

Mass Emissions Modeling

The project would affect long-distance, city-to-city travel along freeways and highways throughout the state (on-road vehicles), as well as long-distance, city-to-city aircraft takeoffs and landings (aircraft). The HSR system would also affect electrical demand throughout the state (power plants). Because the project would use electric multiple-unit (EMU) trains, train operations would not produce direct emissions from combustion of fossil fuels. However, fugitive dust from the surface surrounding the track would be resuspended by the trains traveling at high velocities (train movement). The new and expanded stations and maintenance facilities would generate local emissions from mobile sources and building operation (stations and maintenance facilities). Finally, new circuit breakers installed as part of the PG&E reconductoring work would generate additional SF_6 emissions (circuit breakers). The Authority considered emissions from these seven sources—on-road vehicles, aircraft, power plants, train movement, stations, maintenance facilities, and circuit breakers—in the analysis of operations air quality impacts, as described in the following subsections.

Operational Emission Sources

- **On-Road Vehicles**: Displaced public vehicle trips from mode shift to passenger rail.
- **Aircrafts**: Displaced public aircraft trips from mode shift to passenger rail.
- **Power Plants**: Electricity generation and distribution to power EMUs.
- **Train Movement**: Fugitive dust suspended by train movement over the rail track.
- **Stations**: Area sources (e.g., landscaping equipment), electricity and water consumption, waste generation, emergency generator testing, and vehicle traffic associated with station operation.
- **Maintenance Facilities**: Employee, delivery, and rail trips, as well as off-road maintenance equipment.
- **Circuit Breakers**: Annual leakage of SF_6 emissions.

On-Road Vehicles

Project operations would provide expanded passenger rail service between San Jose and Merced that would reduce passenger vehicle usage. The Authority evaluated reductions in on-road vehicle emissions using average daily displaced VMT estimates and the CARB's EMFAC2017 model. Appendix 3.2-B, Vehicle Miles Traveled Forecasting, describes the methodology used for forecasting the reduction in VMT. Emission reductions from displaced VMT were calculated by multiplying the estimated VMT by the applicable pollutant's emission factors from EMFAC2017, which are based on speed, vehicle mix, and analysis year.

Aircraft

Like on-road vehicles, project operations would reduce aviation demand throughout the state. The Authority used the estimated number of air trips removed attributable to the HSR system and the Federal Aviation Administration's Aviation Environmental Design Tool to estimate criteria pollutant benefits from reduced aircraft activity. The Authority modeled GHG reductions using fuel consumption and emission factors from the CARB's 2000–2018 Documentation of California's Greenhouse Gas Inventory (13th Edition) and the accompanying documentation (CARB 2020a). The analysis also accounts for criteria pollutant and GHG benefits from reduced ground-maintenance equipment, which were calculated using USEPA's OFFROAD model.

Power Plants

Propulsion of the EMUs would consume electricity, which would be generated by power plants throughout the state. The Authority quantified criteria pollutant and GHG emissions based on the estimated annual electricity demand for the project and emission factors from the CARB and

[12] As described in Volume 2, Appendix 3.3-C, Changes to Project Benefits Based on 2018 Business Plan, the Authority Board adopted the 2018 Business Plan on May 15, 2018. The 2018 Business Plan assumes an opening year of 2033 for Phase 1 and presents different ridership forecasts for 2029 and 2040 than were assumed in this EIR/EIS. Under the 2018 Business Plan ridership forecasts, the HSR project would achieve the same benefits described in this section, but they would occur at different times and may be less than those presented in Section 3.3.6, Environmental Consequences. Nonetheless, HSR would ultimately afford a more energy-efficient choice for personal travel that would help alleviate highway congestion, provide greater capacity for goods movement, and reduce criteria pollutant and GHG emissions.

USEPA. The analysis conservatively assumed the HSR system would be powered by the state's current electrical grid, which is composed of renewable and nonrenewable generating units. Because an increasing fraction of future electricity will be generated by renewable resources, as required by state law (100 percent by 2045), the emissions intensity of the statewide electrical grid would be lower when the HSR system became operational in 2029 and 2040. Accordingly, electricity-related emissions generated by the project are expected to be lower than the emissions estimated for this analysis. Furthermore, under the 2013 Policy Directive POLI-PLAN-03, the Authority has adopted a goal to purchase 100 percent of the HSR system's power from renewable energy sources. This goal also supports the SB 100 policy to require 100 percent renewable energy for supply to electricity end-use customers by 2045.

Train Movement

The Authority estimated resuspended fugitive dust emissions using USEPA's (2006) method for estimating emissions from wind erosion and using assumptions from Watson (1996).

Stations

The project would include an expanded San Jose Diridon Station and either an expanded Downtown Gilroy Station or a new East Gilroy Station. Emissions associated with the operation of the stations would primarily result from area sources (e.g., landscaping equipment), electricity and water consumption, waste generation, emergency generator testing, and vehicle traffic.

Analysts estimated emissions from these sources using CalEEMod (version 2016.3.2)[13] and project-specific data, where available. Specifically, electricity and water consumption for each facility was calculated by scaling existing utility rates (e.g., gallons of water per square foot) from the San Jose Diridon Station (McGuire 2017). This approach is conservative because the project stations would be LEED Platinum[14] certified, which would reduce utility consumption per square foot relative to the existing rate. Analysts also estimated vehicle emissions associated with passenger and employee commutes (Burton 2017–2018).

The San Jose Diridon and Gilroy Stations would have emergency generators that would be used in the event of a power outage. Usage of each of the proposed emergency generators would occur for up to 50 hours per year for periodic testing, consistent with the CARB's Airborne Toxic Control Measure for Stationary Compression Ignition Engines and Section 330.3 of BAAQMD Regulation 9, Rule 8.

Maintenance Facilities

As discussed in Chapter 2, Alternatives, two maintenance facilities would be required for the project. A maintenance of way facility (MOWF) would be built either south of Gilroy (Alternatives 1, 2, and 4) or east of Gilroy (Alternative 3), and a maintenance of way siding (MOWS) would be built near Turner Island Road (Alternatives 1, 2, 3, and 4).

Building operation and emergency generator emissions were estimated using CalEEMod (version 2016.3.2)[11] and default assumptions for the "general light industrial" land use category. Analysts also derived emissions from employee commute and delivery trips using CalEEMod and vehicle trip information estimates (Burton 2017–2018). Emissions from maintenance equipment, vehicle, and rail movement at the MOWF were estimated using a combination of emission factors and methodologies from CalEEMod, EMFAC2017, and USEPA (2009).

---

[13] Analysts adjusted the predicted passenger and employee vehicle emissions to reflect the impact of the SAFE Vehicles Rule, as per CARB (2019a, 2020b) guidance. As discussed in Section 3.3.2.1, Federal, the SAFE Vehicles Rule only affects fuel economy and associated emissions from light-duty gasoline vehicles. However, the adjustment factors were conservatively applied to the entire CalEEMod output for on-road mobile, which includes emissions contributions from gasoline and diesel-powered vehicles.

[14] LEED, or Leadership in Energy and Environmental Design, is a widely used green building rating system developed by the United States Green Building Council. Projects pursing LEED earn points based on energy use, materials, water efficiency, and other sustainability criteria. LEED platinum is the highest rating level, corresponding to at least 80 points earned.

Circuit Breakers

Operations and maintenance activities required for the reconductored Spring to Llagas and Green Valley to Llagas power lines would not change from those currently required for the existing system; thus, no additional operations-related criteria pollutants would occur. However, the project would require the installation of electrical equipment, including up to 12 power circuit breakers with SF_6 gas insulated switchgear. Analysts estimated potential GHG emissions (SF_6) from the additional breakers based on the mass of each breaker (230 pounds) and an assumed 0.5 percent by mass annual leak rate, per PG&E standard specifications.

Carbon Monoxide Hot Spots

Traffic around the San Jose Diridon and Gilroy Stations and affected by grade crossings (Alternative 4 only) may contribute to localized increases in CO, known as CO "hot spots." As discussed further in Section 3.3.4.5, Method for Determining Significance under CEQA, the BAAQMD has adopted screening criteria that provide a conservative indication of whether project-generated traffic would cause a potential CO hot spot. Traffic data provided by Fehr & Peers (Burton 2017–2019) indicate that no intersections in the local RSA would exceed the 24,000 vehicles per hour screening criteria. However, up to 20 intersections, depending on the alternative, would violate the established level-of-service (LOS) standard in the applicable congestion management program (CMP) under 2040 Plus Project conditions, thereby failing one of BAAQMD's CO screening criteria.

Analysts performed a microscale CO hot-spot analysis at the following five locations to verify that station traffic would not cause or contribute to a violation of the CO CAAQS. These intersections were selected because they were identified as having the highest traffic volumes and worst levels of congestion/delay of the 20 intersections that would violate CMP LOS standards.

- The Alameda (State Route [SR] 82)/Taylor Street-Naglee Avenue
- Autumn Street (SR 82)/West Santa Clara Street (SR 82)
- Coleman Avenue/Interstate (I-) 880 Northbound Ramps
- Monterey Road (SR 82)/Blossom Hill Road Westbound Ramps (SR 82/County Route G10)
- U.S. Highway (US) 101 Southbound Ramps/Blossom Hill Road

In addition to these locations, the intersection of Monterey Road and Skyway Drive was analyzed under Alternative 4. The traffic analysis indicates that this intersection would have the highest traffic volumes and worst congestion of the locations analyzed with at-grade crossings (Burton 2017–2019).

Analysts evaluated the potential for CO hot spots using the California Department of Transportation Institute of Transportation Studies *Transportation Project-Level Carbon Monoxide Protocol* (CO Protocol) (Garza et al. 1997) and traffic data from Fehr & Peers (Burton 2017–2019). Analysts adjusted the predicted CO concentrations to reflect the impact of the SAFE Vehicles Rule, as per CARB (2019a) guidance. As discussed in Section 3.3.2.1, Federal, the SAFE Vehicles Rule only affects fuel economy and associated emissions from light-duty gasoline vehicles. However, the adjustment factors were conservatively applied to the entire modeled CO concentration, which includes emissions contributions from gasoline and diesel-powered vehicles.

Particulate Matter Hot Spots

PM hot spots may be created by localized increases in vehicle or rail traffic, particularly when that traffic consists of a significant number of diesel-powered vehicles. Redistributing or moving vehicle or rail traffic would also increase PM concentrations at certain locations and result in corresponding decreases in other locations. This section briefly discusses methods for evaluating potential PM hot spots from changes in on-road vehicle and freight rail traffic.

On-Road Vehicles

Although the project is not subject to transportation conformity, portions of the local RSA are classified as either nonattainment or maintenance for the federal PM_{10} or $PM_{2.5}$ standards. Consequently, analysts conducted a hot-spot analysis following USEPA's 2015 *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and*

Maintenance Areas (USEPA 2015). The analysis focused on potential air quality concerns under NEPA from the project's effects on roads and followed the recommended practice in USEPA's Final Rule regarding the localized or hot-spot analysis of $PM_{2.5}$ and PM_{10} (40 C.F.R. Part 93, issued March 10, 2006).

Freight Rail

Neither Union Pacific Railroad (UPRR) service nor associated emissions from locomotive operation would be affected, relative to existing conditions. While the source of PM emissions would shift commensurate with the lateral track shift, the amount of emissions, and therefore the potential for the project to result in new or worsened PM hot spots would not change. Accordingly, analysts did not conduct a PM hot-spot analysis for the relocated freight because the project would not change the amount of freight emissions. Potential changes in receptor exposure to DPM and $PM_{2.5}$ are analyzed under the Operations Health Risk Assessment subsection below.

Mobile Source Air Toxics

The Federal Highway Administration's (FHWA) (2016) *Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents* provides advice on when and how to analyze MSATs in the NEPA process for highway projects. Depending on the specific project circumstances, FHWA has identified the following three categories of analysis:

- **Tier 1**—No analysis for projects without any potential for meaningful MSAT effects
- **Tier 2**—Qualitative analysis for projects with low potential MSAT effects
- **Tier 3**—Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects

Analysts assessed potential MSAT effects associated with the project alternatives according to FHWA's updated interim guidance and the project analysis tiers. The project would reduce regional VMT and traffic congestion, resulting in a reduction in MSAT emissions. The level of effects from regional MSAT emissions, therefore, corresponds to FHWA's Tier 1 and no further analysis was conducted. Changes in vehicle activity could result in localized MSAT increases. The potential level of effects from these circumstances corresponds to FHWA's Tier 2 and qualitative analysis was conducted.

Operations Health Risk Assessment

Freight Relocation

Project construction would reposition existing UPRR tracks. Redistributing or moving existing freight traffic would increase TAC concentrations at certain receptor locations and would result in corresponding decreases at other locations. Diesel-related exhaust, specifically DPM, is considered a carcinogenic TAC by the CARB, so an HRA was conducted to assess the risk (i.e., cancer and noncancer risks) associated with changes in operational freight activity.

Analysts used the BAAQMD's existing inventory of health risks from rail sources in the SFBAAB (Winkel 2018) to calculate the net effect of health risks associated with moving freight closer to sensitive receptors. The orientation and distance of the relocated track to existing receptors would change throughout the alignment; therefore, analysts estimated health risks at multiple locations to capture the range of potential project impacts. Analysts selected those locations where the difference in distance between the relocated and existing tracks was greatest relative to existing sensitive receptors.

Data from the Peninsula Corridor Joint Powers Board (2015) and USEPA (2009) were used to account for anticipated growth in freight traffic and changes in locomotive emission rates. The analysis assumes the freight relocation would be complete by 2022.

Diesel Buses

The San Jose Diridon and Gilroy Stations would be served by diesel-powered buses, which generate TACs at idle while loading and unloading passengers. Improved bus service to existing passenger rail terminals (San Jose Diridon and Downtown Gilroy Stations) is not part of the project. The Authority assumes that bus service levels are constant into the future because no

operator has a funding plan to deliver more service. Buses operated by the Santa Clara Valley Transportation Authority (VTA) are a mix of diesel- and diesel-electric–powered vehicles. While bus service levels are assumed to be the same for either with or without project conditions, the East Gilroy Station would be an entirely new transit stop with HSR conditions. Analysts evaluated potential health risks from exposure to diesel exhaust under this specific project-induced change using transit data and USEPA's AERMOD dispersion (Burton 2019).

Emergency Generators

The San Jose Diridon and Gilroy Stations and the MOWS and MOWF would have emergency generators that would be used in the event of a power outage. These generators would be subject to the permitting requirements specified in BAAQMD Regulation 2, Rule 5, Section 302. Based on these permitting requirements, the generators would not be allowed to operate if they would result in cancer or acute hazard impacts in excess of the BAAQMD's health risk thresholds of significance. However, Regulation 2, Rule 5 does not address $PM_{2.5}$ concentrations or permit restrictions for facilities with emissions in excess of the BAAQMD's threshold of 0.3 micrograms per cubic meter ($\mu g/m^3$). Accordingly, $PM_{2.5}$ exhaust concentrations from emergency generator testing were estimated using USEPA's AERMOD dispersion model and emission data from CalEEMod.

Maintenance of Way Facility Maintenance Activities

The MOWF would use diesel-powered off-road equipment, vehicles, and locomotives to support maintenance and repair activities. Cancer and noncancer health risks, as well as $PM_{2.5}$ concentrations, were modeled using USEPA's AERMOD dispersion model. The analysis was conducted using the same general method and guidance as described for the construction HRA.

3.3.4.4 Method for Evaluating Impacts under NEPA

CEQ NEPA regulations (40 C.F.R. Parts 1500–1508) provide the basis for evaluating project effects (Section 3.1.6.4). As described in Section 1508.27 of these regulations, the criteria of context and intensity are considered together when determining the severity of the change introduced by the project:

- **Context**—For this analysis, the *context* would include existing conditions within the SFBAAB, NCCAB, and SJVAB, including the regional attainment status, existing ambient air quality monitoring data, and applicable regulations, as established by USEPA and the CARB, as well as existing conditions along the project footprint and within 1,000 feet of construction work areas and permanent project features, including the number and location of sensitive receptors.
- **Intensity**—For this analysis, *intensity* is determined by assessing the following conditions: (1) whether the project would conflict with implementation of applicable air quality plans, (2) whether the project threatens to violate or contributes to an existing or projected air quality violation, and (3) the degree to which the project would affect public health by exposing sensitive receptors to pollutant concentrations.

Analysts used the General Conformity Rule *de minimis* thresholds (40 C.F.R. Section 93.153) (Table 3.3-3) to inform the severity of an effect, where emissions in excess of these thresholds indicates that the project would not conform to the appropriate air basin SIPs. Analysts assumed that general conformity would apply only to construction of the project because the analysis demonstrates that HSR operations will decrease regional emissions of criteria pollutants.

Table 3.3-3 General Conformity Rule *de minimis* Thresholds for the Project

Air Basin	Annual Air Pollutant Emissions in Tons per Year					
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$	SO_2
SFBAAB[1]	100	100	None	None	100	100
NCCAB[2]	None	None	None	None	None	None
SJVAB[1]	10	10	None	100	70	70

[1] The General Conformity *de minimis* thresholds for criteria pollutants are based on the federal attainment status of the RSA in the SFBAAB and SJVAB. Although the RSA is in attainment for SO_2, because SO_2 is a precursor for $PM_{2.5}$, the $PM_{2.5}$ General Conformity *de minimis* thresholds are used.
[2] The NCCAB is considered attainment for all criteria pollutants. As such, a general conformity analysis is not required and there are no applicable *de minimis* thresholds.
CO = carbon monoxide
NCCAB = North Central Coast Air Basin
NO_X = nitrogen oxides
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
PM_{10} = particulate matter 10 microns or less in diameter
VOC = volatile organic compounds
RSA = resource study area
SFBAAB = San Francisco Bay Area Air Basin
SJVAB = San Joaquin Valley Air Basin
SO_2 = sulfur dioxide

3.3.4.5 Method for Determining Significance under CEQA

CEQA requires that an EIR identify the significant environmental impacts of a project (CEQA Guidelines § 15126). One of the primary differences between NEPA and CEQA is that CEQA requires a significance determination for each impact using a threshold-based analysis (see Section 3.1.6.4, Methods for Evaluating Impacts, for further information). By contrast, under NEPA, significance is used to determine whether an EIS will be required. NEPA requires that an EIS be prepared when the proposed federal action (project) as a whole has the potential to "significantly affect the quality of the human environment." Accordingly, Section 3.3.9, CEQA Significance Conclusions, summarizes the significance of the environmental impacts on air quality and global climate change for the project. The Authority is using the following thresholds to determine if a significant impact on air quality and global climate change would occur as a result of the project. A significant impact is one that would:

- Conflict with or obstruct implementation of the applicable air quality plan.
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard.
- Expose sensitive receptors to substantial pollutant concentrations.
- Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people.
- Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment.
- Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.

As discussed throughout this section, the significance of air quality impacts is based largely on compliance with state and federal air quality standards, as well as standards and plans developed by local air districts. The primary federal and state standards are the NAAQS and CAAQS, respectively. Both the NAAQS and CAAQS have been established to protect public health and welfare. Local air districts are required to develop plans and control programs for attaining the state standards, which are generally more stringent than the corresponding federal standards and incorporate standards for additional pollutants. The air districts have also developed health-based

guidance for assessing the significance of other pollutants, including asbestos. Therefore, the NAAQS and CAAQS, as well as the standards and plans developed by the air districts, provide appropriate thresholds for determining whether project-related emissions would result in a significant impact. The quantitative emissions thresholds developed by the regional air districts to evaluate the significance level of impacts are discussed in the following sections.

The analysis of localized impacts and health risks also relies on standards developed by OEHHA. OEHHA is the lead state agency for the assessment of health risks posed by environmental contaminants, including TACs and other pollutants. The agency's mission is to protect human health and the environment through scientific evaluation of risks posed by hazardous substances. The standards developed by OEHHA are based on extensive scientific evidence and are specifically intended for the protection of human health and the environment.

Impacts related to GHG emissions are evaluated based on consistency with established statewide GHG reduction goals, including the goals set forth in AB 32 and SB 32. AB 32 required California to reduce GHG emissions to 1990 levels by 2020, and SB 32 continues that timeline and requires greater reduction in GHG emissions. The GHG reduction goals are based on scientific consensus on the GHG emissions reduction needed to avert the worst effects of climate change. The CEQA Guidelines provide that a lead agency may consider a project's consistency with the State's long-term climate goals or strategies in determining the significance of impacts (CEQA Guidelines §15064.4).

In December 2018, the California Supreme Court issued its decision in *Sierra Club v. County of Fresno* (6 Cal. 5th 502) (hereafter referred to as the Friant Ranch Decision). The case considered a challenge to the long-term, regional air quality analysis in the EIR for the proposed Friant Ranch development. The Friant Ranch project is a 942-acre master-plan development in unincorporated Fresno County within the SJVAB. The Court concluded that the air quality analysis was inadequate because it failed to provide enough detail "for the public to translate the bare [criteria pollutant emissions] numbers provided into adverse health impacts or to understand why such a translation is not possible at this time." The Court's decision clarifies that environmental documents must connect a project's air quality impacts to specific health effects or explain why it is not technically feasible to perform such an analysis.

All criteria pollutants that would be generated by the proposed project are associated with some form of health risk (e.g., asthma). The potential for pollutants to affect public health depends on a multitude of variables, including how they are dispersed and transported in the atmosphere. As discussed above, both construction and operations of the project would generate regional ozone precursors (VOC and NO_X) and PM emissions. The project would also result in localized emissions of CO, NO_2, PM, and SO_2.

Quantitative emission thresholds that can be used to evaluate the significance level of regional and localized pollutants are discussed in the following subsection. To the degree feasible, the following sections discuss the project's air quality impacts in terms of specific health effects or explain why it is not technically feasible to perform such an analysis in accordance with the Friant Ranch Decision.

Regional Emissions Supplemental Thresholds

Adverse health effects induced by regional criteria pollutant emissions generated by the project (ozone precursors and PM) depend on numerous interconnected variables (e.g., cumulative concentrations, local meteorology and atmospheric conditions, the number and character of exposed individuals [e.g., age, gender]). For these reasons, ozone precursors (VOC and NO_X) contribute to the formation of ground-borne ozone on a regional scale, where emissions of VOC and NO_X generated in one area may not equate to a specific ozone concentration in that same area. Similarly, some types of particulate pollutants may be transported over long distances or formed through atmospheric reactions. As such, the magnitude and locations of specific health effects from exposure to increased ozone or regional PM concentrations are the product of emissions generated by numerous sources throughout a region, as opposed to a single individual project.

Technical limitations of existing models to correlate project-level regional emissions to specific health consequences are recognized by air quality management districts throughout the state, including the SJVAPCD and South Coast Air Quality Management District (SCAQMD), who provided *amici curiae* briefs for the Friant Ranch legal proceedings. In its brief, SJVAPCD (2015c) acknowledges that while HRAs for localized air toxics, such as DPM, are commonly prepared, "it is not feasible to conduct a similar analysis for criteria air pollutants because currently available computer modeling tools are not equipped for this task." The air district further notes that emissions solely from the Friant Ranch project (which equate to less than one-tenth of one percent of the total NO_X and VOC in the Valley) is not likely to yield valid information, and that any such information should not be "accurate when applied at the local level." SCAQMD (2015) presents similar information in their brief, stating that "it takes a large amount of additional precursor emissions to cause a modeled increase in ambient ozone levels."[15]

The BAAQMD's (2017a), MBARD's (2008), and SJVAPCD's (2015a) CEQA guidelines contain emissions thresholds used to evaluate the significance of a project's regional emissions (Table 3.3-4). If a project's emissions are below the significance thresholds, impacts would be considered less than significant and the project would not be expected to contribute a significant level of air pollution such that regional air quality in the basin would be degraded. If the construction- or operations-phase emissions are greater than these values, impacts for that phase would be considered significant and project-generated emissions may contribute to cumulative and regional health effects. In such cases, all feasible mitigation is applied, and emissions are reduced to the extent possible.

The air district thresholds presented in Table 3.3-4 consider existing air quality concentrations and attainment or nonattainment designations under the NAAQS and CAAQS. The NAAQS and CAAQS are informed by a wide range of scientific evidence that demonstrates there are known safe concentrations of criteria pollutants. While recognizing that air quality is a cumulative problem, the air districts consider projects that generate criteria pollutant and ozone precursor emissions below these thresholds to be minor in nature and would not adversely affect air quality such that the NAAQS or CAAQS would be exceeded. Emissions generated by the project could increase photochemical reactions and the formation of tropospheric ozone and secondary PM, which at certain concentrations, could lead to increased incidence of specific health consequences. Although these health effects are associated with ozone and particulate pollution, the effects are a result of cumulative and regional emissions. As such, for project's with relatively small emissions contributions (i.e., emissions below the regional air district thresholds), that project's incremental contribution cannot be traced to specific health outcomes on a regional scale, and a quantitative correlation of project-generated regional criteria pollutant emissions to specific human health impacts is not technically feasible.

[15] For example, SCAQMD's analysis of their 2012 Air Quality Attainment Plan showed that modeled NOx and VOC reductions of 432 and 187 tons per day, respectively, only reduced ozone levels by 9 parts per billion. Analysis of SCAQMD's Rule 1315 showed that emissions of NOx and VOC of 6,620 and 89,180 pounds per day, respectively, contributed to 20 premature deaths per year and 89,947 school absences (SCAQMD 2015).

Table 3.3-4 BAAQMD, MBARD, and SJVAPCD Regional Mass Emission Thresholds

Analysis	BAAQMD[1]	MBARD	SJVAPCD
Construction	VOC: 54 lbs/day NO_X: 54 lbs/day PM_{10}: 82 lbs/day (exhaust only) $PM_{2.5}$: 54 lbs/day (exhaust only)	PM_{10}: 82 lbs/day[2]	VOC: 10 tons/year or 100 lbs/day[3] NO_X: 10 tons/year or 100 lbs/day[3] PM_{10}: 15 tons/year or 100 lbs/day[3] $PM_{2.5}$: 15 tons/year or 100 lbs/day[3] CO: 100 tons/year or 100 lbs/day[3, 4] SO_X: 27 tons/year or 100 lbs/day[3, 4]
Operation	VOC: 54 lbs/day or 10 tons/year NO_X: 54 lbs/day or 10 tons/year PM_{10}: 82 lbs/day or 15 tons/year $PM_{2.5}$: 54 lbs/day or 10 tons/year	VOC: 137 lbs/day NO_X: 137 lbs/day CO: 550 lbs/day PM_{10}: 82 lbs/day SO_2: 150 lbs/day	Same as construction

Sources: BAAQMD 2017a; MBUAPCD 2008; SJVAPCD 2015a

[1] BAAQMD's CEQA Guidelines state that the thresholds should be applied to average daily emissions. However, consultation with air district staff indicates that maximum daily emissions should be used to determine project-level impacts. Accordingly, this analysis conservatively applies BAAQMD's thresholds to maximum daily emissions.

[2] According to MBARD's CEQA guidelines, construction projects that temporarily emit precursors of O_3 (i.e., VOC or NO_X) are accommodated in the emission inventories of state and federally required air plans and would not have a significant impact on the attainment and maintenance of state or federal O_3 ambient air quality standard (MBUAPCD 2008). The MBARD guidelines have an exception if a project uses "non-typical equipment, e.g., grinders, and portable equipment"; the project would use standard construction equipment.

[3] The 100-pound-per-day threshold is a screening-level threshold to help determine whether increased emissions from a proposed project will cause or contribute to a violation of CAAQS or NAAQS. Projects with emissions below the threshold would not be in violation of CAAQS or NAAQS. Projects with emissions above the threshold would require an ambient air quality analysis to confirm this conclusion (SJVAPCD 2015a). The 100-pound-per-day threshold is applied to average daily emissions, which are calculated by amortizing emissions over the number of working days in each construction year.

[4] While CO and SO_X have more direct and localized impacts, SJVAPCD has adopted a "regional" threshold that considers basin-wide effects of cumulative CO and SO_X emissions with respect to attainment of the ambient air quality standards.

BAAQMD = Bay Area Air Quality Management District
CAAQS = California ambient air quality standards
CEQA = California Environmental Quality Act
CO = carbon monoxide
lbs = pounds
MBARD = Monterey Bay Air Resources District
NAAQS = National ambient air quality standards
NO_X = nitrogen oxide
O_3 = ozone
$PM_{2.5}$ = particulate matter that is 2.5 microns in diameter and smaller
PM_{10} = particulate matter that is 10 microns in diameter and smaller
SJVAPCD = San Joaquin Valley Air Pollution Control District
SO_X = sulfur oxide
SO_2 = sulfur dioxide
VOC = volatile organic compound

Localized Emissions Supplemental Thresholds

Criteria Pollutants

Localized criteria pollutants generated by a project are deposited and potentially affect population near the emissions source. Because these pollutants dissipate with distance, emissions from individual projects can result in direct and material health impacts on adjacent sensitive receptors. As discussed above, the NAAQS and CAAQS are health protective standards and define the maximum amount of ambient pollution that can be present without harming public health. Epidemiological, controlled human exposure, and toxicology studies evaluate potential health and environmental effects of criteria pollutants, and form the scientific basis for new and revised ambient air quality standards.

For localized emissions of CO, NO_2, and SO_2, the threshold is the ambient air quality standard for each respective pollutant (Table 3.3-1). The increase in pollutant concentration associated with project emissions is added to the existing concentration to estimate the total ambient air pollutant concentration for comparison with the threshold. If concentrations are below the standard,

impacts would be considered less than significant and the project would not result in a localized public health concern. If concentrations are greater than the standards, impacts would be considered significant and the project may contribute to localized health effects.

Existing concentrations of PM_{10} and $PM_{2.5}$ in most of the RSA already exceed the ambient air quality standards. Analysts evaluated the potential for the project to worsen these existing violations by comparing the incremental project increase in PM concentrations to the applicable significant impact levels (SIL), as recommended by the SJVAPCD (2015a) and BAAQMD (Kirk 2016). This analysis uses the fugitive sources SILs because the construction-related emissions are principally from fugitive sources. These SILs are 10.4 $\mu g/m^3$ and 1.2 $\mu g/m^3$ for the 24-hour average PM_{10} and $PM_{2.5}$ concentrations, respectively, and 2.08 $\mu g/m^3$ and 0.2 $\mu g/m^3$ for the annual average PM_{10} and $PM_{2.5}$ concentrations, respectively. An incremental increase that does not exceed the SILs would not be considered to contribute substantially to further exceedances of the ambient air quality standards or public health effects.

Carbon Monoxide Concentrations from On-Road Vehicles

As discussed in Section 3.3.4.3, Methods for Impact Analysis, the BAAQMD has also adopted the following screening criteria that provide a conservative indication of whether project-generated traffic would cause a potential CO hot spot:

- Project traffic would not increase traffic volumes at affected intersections to more than 44,000 vehicles per hour.
- Project traffic would not increase traffic volumes at affected intersections to more than 24,000 vehicles per hour where vertical and/or horizontal mixing is substantially limited (e.g., tunnel, parking garage, bridge underpass, natural or urban street canyon, below-grade roadway).
- The project is consistent with an applicable CMP established by the county congestion management agency for designated roads or highways, RTP, and local congestion management agency plans.

The BAAQMD's screening criteria are used to evaluate whether additional project traffic would result in a CO hot spot. The health-protective CO CAAQS is used as a quantitative threshold for intersections that violate the screening criteria.

The MBARD and SJVAPCD have also adopted screening criteria for the analysis of CO hot spots from project-generated traffic. These criteria are based on whether a project would reduce the LOS at affected intersections to LOS E or F. Given that BAAQMD's screening criteria include quantitative criteria based on the number of additional vehicles added to affected intersections, BAAQMD's screening criteria are conservatively used to evaluate whether project traffic along the entire RSA would result in a CO hot spot and violation of the CO CAAQS.

Diesel Particulate Matter and Localized Particulate Matter

The BAAQMD, MBARD, and SJVAPCD have adopted separate thresholds to evaluate receptor exposure to DPM emissions. The "substantial" DPM threshold defined by the BAAQMD and MBARD is the probability of contracting cancer for the maximum exposed individual exceeding 10 in 1 million, or the ground-level concentrations of noncarcinogenic TACs resulting in a hazard index greater than 1 for the maximum exposed individual. SJVAPCD's hazard index is also greater than 1 for the maximum exposed individual, but its cancer risk threshold is 20 in 1 million.

The BAAQMD has adopted an incremental concentration-based significance threshold to evaluate receptor exposure to localized $PM_{2.5}$, where a "substantial" contribution is defined as $PM_{2.5}$ exhaust (diesel and gasoline) concentrations exceeding 0.3 $\mu g/m^3$. PM_{10} from earthmoving activities is expected to be significant without application of dust control measures. The SJVAPCD also requires dust control measures to reduce fugitive $PM_{2.5}$ and PM_{10} during construction activities.

The BAAQMD's cumulative cancer risk threshold is 100 cases per million and its noncancer thresholds are a hazard index of greater than 10.0 and a $PM_{2.5}$ concentration of greater than 0.8 $\mu g/m^3$. Neither the SJVAPCD nor MBARD have adopted cumulative health risk thresholds.

Table 3.3-5 summarizes the cancer and noncancer health risk thresholds used in the analysis.

Table 3.3-5 BAAQMD, MBARD, and SJVAPCD Cancer and Noncancer Health Risk Thresholds

Air District	Cancer Risk	Hazard Index	$PM_{2.5}$ Concentration ($\mu g/m^3$)
BAAQMD	10 per million (project) 100 per million (cumulative)	1.0 (project) 10.0 (cumulative)	0.3 (project) 0.8 (cumulative)
MBARD	10 per million (project and cumulative)	1.0 (project and cumulative)	-
SJVAPCD	20 per million (project and cumulative)	1.0 (project and cumulative)	-

Sources: BAAQMD 2017a; MBUAPCD 2008; SJVAPCD 2015a
$PM_{2.5}$ = particulate matter that is 2.5 microns in diameter and smaller
$\mu g/m^3$ = micrograms per cubic meter
- = no threshold
BAAQMD = Bay Area Air Quality Management District
MBARD = Monterey Bay Air Resources District
SJVACPD = San Joaquin Valley Air Pollution Control District

Asbestos and Lead-Based Paint

There are no quantitative thresholds related to receptor exposure to asbestos and LBP. However, the BAAQMD, MBARD, and SJVAPCD require the demolition or renovation of asbestos- or LBP-containing building materials to comply with the limitations of the National Emissions Standards for Hazardous Air Pollutants regulations (40 C.F.R. Parts 61 and 63).

Greenhouse Gas Emissions Supplemental Thresholds

GHG emissions and global climate change represent cumulative impacts of human activities and development projects locally, regionally, nationally, and worldwide. GHG emissions cumulatively contribute to the environmental impacts of global climate change. No single project could generate enough GHG emissions to noticeably change the global average temperature; instead, the combination of GHG emissions from past, present, and future projects and activities have and will continue to contribute to global climate change and its associated environmental impacts.

None of the local air districts (BAAQMD, MBARD, or SJVAPCD) have adopted a GHG emission threshold for construction-related emissions. The BAAQMD recommends that GHG emissions from construction be quantified and disclosed, and that a determination regarding the significance of these GHG emissions be made with respect to whether a project is consistent with the AB 32 GHG emission reduction goals. The BAAQMD further recommends incorporation of best management practices (BMP) to reduce GHG emissions during construction, as feasible and applicable.

The BAAQMD and SJVAPCD have established significance thresholds to evaluate operations emissions, which apply only to land use development and stationary source projects. Similarly, MBARD recommends use of San Luis Obispo Air Pollution Control District's (SLOAPCD) residential/commercial land use threshold (Clymo 2015). The BAAQMD's, SJVAPCD's, and SLOAPCD's thresholds were also established based on statewide emission reduction goals outlined in AB 32, and do not consider deeper reductions that would be required to meet the long-term goals of SB 32, EO S-03-05, or EO B-55-18.

The project is a transportation project that does not fit into the land use development or stationary source project categories. Accordingly, there are no adopted quantitative GHG thresholds relevant to the project. Therefore, direct and indirect GHG emissions from the project are discussed with respect to larger statewide GHG emission reduction goals, where a significant impact would occur if project emissions would obstruct attainment of the targets outlined under AB 32, SB 32, EO S-03-05, or EO B-55-18.

3.3.5 Affected Environment

This section discusses the affected environment related to air quality and GHGs in the respective RSAs. The affected environment would be identical for all project alternative, because all project alternatives would be within the same regional air basins. This information provides the context for the environmental analysis and the evaluation of impacts. Refer to the Air Quality and Greenhouse Gases Technical Report (Volume 2, Appendix 3.3-A) for more detailed information on the affected environment.

3.3.5.1 Air Quality

Meteorology and Climate

California is divided into 15 air basins based on geographic features that create distinctive regional climates. The project alternatives cross the SFBAAB, NCCAB, and SJVAB. Accordingly, local meteorological conditions vary greatly in the RSA because of topography and elevation, as well as proximity to local waterbodies. This section briefly discusses climate and meteorological information associated with the three project air basins.

San Francisco Bay Area Air Basin (Santa Clara Valley Subregion)

The portion of the project in the SFBAAB crosses the Santa Clara Valley subregion. Warm summer temperatures, mild winds, and mountains surrounding the valley tend to combine to promote O_3 formation. In addition to the many local sources of pollution, prevailing winds carry O_3 precursors from surrounding counties to the Santa Clara Valley. The valley tends to channel pollutants to the southeast. On summer days, O_3 can be recirculated throughout the region. A similar recirculation pattern occurs in the winter, affecting levels of CO and PM. This movement of the air up and down the valley significantly increases the effects of pollutants (BAAQMD 2017a).

North Central Coast Air Basin

The NCCAB comprises Monterey, Santa Cruz, and San Benito Counties. A small portion of the project alignment south of Gilroy falls within the NCCAB. The semi-permanent high-pressure cell in the eastern Pacific, known as the Pacific High, is the basic controlling factor in the climate of the air basin. In the summer, the high-pressure cell is dominant and frequently leads to temperature inversions that inhibit air movement. In the fall, weak offshore flows can transport pollutants from the Bay Area or Central Valley into the NCCAB, leading to higher levels of air pollution. Air quality is generally good in the winter and early spring as the Pacific High migrates southward and has less influence on the air basin (MBUAPCD 2008).

San Joaquin Valley Air Basin

The SJVAB contains all of San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, and Tulare Counties, as well as a portion of Kern County. The portion of the project from the Pacheco Pass east falls within the SJVAB. The area has an inland Mediterranean climate that is characterized by warm, dry summers and cool winters. Although marine air generally flows into the basin from the Delta, the surrounding mountain ranges restrict air movement through and out of the valley, leading to frequent temperature inversions and poor air quality. Elevated pollutant concentrations are sometimes mediated by precipitation and fog, which tends to be greatest in the northern part of the air basin (SJVAPCD 2015a).

Pollutants of Concern

As discussed above, the federal and state governments have established NAAQS and CAAQS, respectively, for six criteria pollutants. All criteria pollutants can have human health and environmental effects at certain concentrations. The ambient air quality standards for these pollutants (Table 3.3-1) are set to project public health and the environment within an adequate margin of safety (CAA Section 109). Principal characteristics and possible health and environmental effects from exposure to the primary criteria pollutants generated by the project are discussed in the following subsections. This section also summarizes potential health effects from exposure to TAC and Valley fever.

Ozone and Precursor Emissions (VOC and NO_X)

Ozone, or smog, is photochemical oxidant that is formed when VOC and NO_X (both by-products of the internal combustion engine) react with sunlight. VOC are compounds made up primarily of hydrogen and carbon atoms. Internal combustion associated with motor vehicle usage is the major source of hydrocarbons. Other sources of VOC are emissions associated with the use of paints and solvents, the application of asphalt paving, and the use of household consumer products such as aerosols. The two major forms of NO_X are nitric oxide (NO) and NO_2. NO is a colorless, odorless gas formed from atmospheric nitrogen and oxygen when combustion takes place under high temperature and/or high pressure. NO_2 is a reddish-brown irritating gas formed by the combination of NO and oxygen. In addition to serving as an integral participant in ozone formation, NO_X also directly acts as an acute respiratory irritant and increases susceptibility to respiratory pathogens.

Ozone poses a higher risk to those who already suffer from respiratory diseases (e.g., asthma), children, older adults, and people who are active outdoors. Exposure to ozone at certain concentrations can make breathing more difficult, cause shortness of breath and coughing, inflame and damage the airways, aggregate lung diseases, increase the frequency of asthma attacks, and cause chronic obstructive pulmonary disease (COPD). Studies show associations between short-term ozone exposure and non-accidental mortality, including deaths from respiratory issues. Studies also suggest long-term exposure to ozone may increase the risk of respiratory-related deaths (USEPA 2019a). The concentration of ozone at which health effects are observed depends on an individual's sensitivity, level of exertion (i.e., breathing rate), and duration of exposure. Studies show large individual differences in the intensity of symptomatic responses, with one study finding no symptoms to the least responsive individual after a 2-hour exposure to 400 parts per billion of ozone and a 50 percent decrement in forced airway volume in the most responsive individual. Although the results vary, evidence suggest that sensitive populations (e.g., asthmatics) may be affected on days when the 8-hour maximum ozone concentration reaches 80 parts per billion (USEPA 2019b). For reference, the average background level of ozone in the Bay Area is approximately 45 parts per billion (BAAQMD 2017b).

In addition to human health effects, ozone has been tied to crop damage, typically in the form of stunted growth, leaf discoloration, cell damage, and premature death. Ozone can also act as a corrosive and oxidant, resulting in property damage such as the degradation of rubber products and other materials.

Carbon Monoxide

Carbon monoxide is a colorless, odorless, toxic gas produced by incomplete combustion of carbon substances, such as gasoline or diesel fuel. In the study area, high CO levels are of greatest concern during the winter, when periods of light winds combine with the formation of ground-level temperature inversions from evening through early morning. These conditions trap pollutants near the ground, reducing the dispersion of vehicle emissions. Moreover, motor vehicles exhibit increased CO emission rates at low air temperatures. The primary adverse health effect associated with CO is interference with normal oxygen transfer to the blood, which may result in tissue oxygen deprivation. Exposure to CO at high concentrations can also cause fatigue, headaches, confusion, dizziness, and chest pain. There are no ecological or environmental effects to ambient CO (CARB 2019b).

Particulate Matter

Particulate matter consists of finely divided solids or liquids such as soot, dust, aerosols, fumes, and mists. Two forms of particulates are now generally considered: inhalable course particles, or PM_{10}, and inhalable fine particles, or $PM_{2.5}$. Particulate discharge into the atmosphere results primarily from industrial, agricultural, construction, and transportation activities. However, wind on arid landscapes also contributes substantially to local particulate loading.

Particulate pollution can be transported over long distances and may adversely affect people's lungs, especially people who are naturally sensitive or susceptible to breathing problems.

Numerous studies have linked PM exposure to premature death in people with preexisting heart or lung disease. Other symptoms of exposure may include nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, and increased respiratory symptoms. Studies show that every 1 µg/m^3 reduction in $PM_{2.5}$ results in a 1 percent reduction in mortality rate for individuals over 30 years old (BAAQMD 2017b). Depending on its composition, both PM_{10} and $PM_{2.5}$ can also affect water quality and acidity, deplete soil nutrients, damage sensitive forests and crops, affect ecosystem diversity, and contribute to acid rain (USEPA 2019c).

Nitrogen Dioxide

As discussed above, NO_2 is formed by the combination of NO and oxygen through internal combustion. Long-term exposure to high concentrations of NO_2 aggravate respiratory diseases, such as asthma (USEPA 2019d). In addition, several epidemiological studies have demonstrated associations between NO_2 exposure and premature death, cardiopulmonary effects, decreased lung function growth in children, emergency room visits for asthma, and intensified allergic responses. Compared to adults, young children and infants tend to be at greater risk because they have higher breathing rates and typically greater outdoor exposure durations. Long-term NO_2 exposure during childhood, the period of rapid lung growth, can lead to smaller lungs at maturity in these children. Children with asthma also have a greater degree of airway responsiveness when exposed to NO_2 at certain concentrations, compared to adult asthmatics. In adults, the greatest risk from NO_2 exposure is to people who have underlying chronic respiratory disease, such as COPD (CARB 2020c). NO_2 can also reduce visibility and react with water, oxygen, and other chemicals to contribute to acid rain, which can harm sensitive ecosystems (USEPA 2019d).

Sulfur Dioxide

SO_2 is generated by burning of fossil fuels, industrial processes, and natural sources, such as volcanoes. Short-term exposure to SO_2 can aggravate the respiratory system, making breathing difficult. SO_2 can also affect the environment by damaging foliage and decreasing plant growth (USEPA 2019e).

Toxic Air Contaminants

Although NAAQS and CAAQS have been established for criteria pollutants, no ambient standards exist for TACs. A TAC is defined by California law as an air pollutant that “may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health.” The primary TACs of concern associated with the project are asbestos and MSAT, including DPM.

Asbestos is the name given to several naturally occurring fibrous silicate minerals. It has been mined for applications requiring thermal insulation, chemical and thermal stability, and high tensile strength. Before the adverse health effects of asbestos were identified, asbestos was widely used as insulation and fireproofing in buildings, and it can still be found in some older buildings. It is also found in its natural state in rock or soil. The inhalation of asbestos fibers into the lungs can result in a variety of adverse health effects, including inflammation of the lungs, respiratory ailments (e.g., asbestosis, which is scarring of lung tissue that results in constricted breathing), and cancer (e.g., lung cancer and mesothelioma, which is cancer of the linings of the lungs and abdomen).

MSATs are a group of 93 compounds emitted from mobile sources that are regulated under USEPA’s 2007 Rule on the Control of Hazardous Air Pollutants from Mobile Sources. USEPA has further identified nine compounds with significant contributions from mobile sources that are among the national- and regional-scale cancer risk drivers. These are acrolein, benzene, 1,3-butadiene, acetaldehyde, DPM, ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter. CARB estimates that DPM emissions are responsible for about 70 percent of the total ambient air toxics risk in California (CARB 2019c). Within the Bay Area, the BAAQMD has found that of all controlled TACs, emissions of DPM are responsible for about 82 percent of the total ambient cancer risk (BAAQMD 2017b). Short-term exposure to DPM can cause acute irritation (e.g., eye, throat, and bronchial), neurophysiological symptoms (e.g., lightheadedness and nausea), and

respiratory symptoms (e.g., cough and phlegm). USEPA has determined that diesel exhaust is "likely to be carcinogenic to humans by inhalation" (USEPA 2002).

Valley Fever

Valley fever is not an air pollutant, but is a disease caused by inhaling *Coccidioides immitis* fungus spores. The spores are found in certain types of soil and become airborne when the soil is disturbed. While *C. immitis* is not typically found in the Bay Area, the fungus is endemic to the Central Valley (California Department of Public Health 2018). Propagation of *C. immitis* is dependent on climatic conditions, with the potential for growth and surface exposure highest following early seasonal rains and long dry spells. *C. immitis* spores can be released when disturbed by earthmoving activities, although receptors must be exposed to and inhale the spores to be at increased risk of developing Valley fever. Moreover, exposure to *C. immitis* does not guarantee that an individual will become ill—approximately 60 percent of people exposed to the fungal spores are asymptomatic and show no signs of an infection (USGS 2000). Individuals with symptoms may develop fever, chest pain, respiratory irritation, headaches, and fatigue.

Ambient Air Quality

The existing air quality conditions in the RSA can be characterized by regional monitoring data. The CARB and various air districts operate air quality monitoring stations throughout California to monitor pollutant concentrations. For the purposes of this analysis, three stations, one in each air basin closest to the project footprint, were selected to represent conditions along the corridor: San Jose–Jackson Street (SFBAAB), Hollister–Fairview Road (NCCAB), and Merced–South Coffee Avenue (SJVAB).

Table 3.3-6 summarizes the results of ambient monitoring at the three stations, where available, for the most recent 3 years of available data (CARB 2018a; USEPA 2018a). Figure 3.3-3 shows the locations of the monitoring stations relative to the project footprint. Between 2015 and 2017, monitored CO and NO_2 concentrations did not exceed any federal or state standards at any of the three monitoring locations. However, the state and federal standards for O_3 and $PM_{2.5}$ and state standard for PM_{10} were exceeded. Using violations of the ambient air quality standards as a proxy for air quality, conditions tend to be poorest in the eastern portion of the RSA in Merced County, with improving air quality as the RSA moves westward to the SFBAAB. As discussed above, the ambient air quality standards define clean air and represent the maximum amount of pollution that can be present in outdoor air without any harmful effects on people and the environment. Existing violations of the ozone and PM ambient air quality standards indicate that certain individuals exposed to this pollutant may experience certain health effects, including increased incidence of cardiovascular and respiratory ailments.

Attainment Status

Local monitoring data (Table 3.3-6) are used to designate areas as nonattainment, maintenance, attainment, or unclassified for the NAAQS and CAAQS. Table 3.3-7 summarizes the attainment status of the portions of the SFBAAB, NCCAB, and SJVAB along the project corridor with regard to the NAAQS and CAAQS.

The four NAAQS/CAAQS designations are defined as follows:

- Nonattainment: Assigned to areas where monitored pollutant concentrations consistently violate the standard in question.
- Maintenance: Assigned to areas where monitored pollutant concentrations exceeded the standard in question in the past, but are no longer in violation of that standard.
- Attainment: Assigned to areas where pollutant concentrations meet the standard in question over a designated period of time.
- Unclassified: Assigned to areas where data are insufficient to determine whether a pollutant is violating the standard in question.

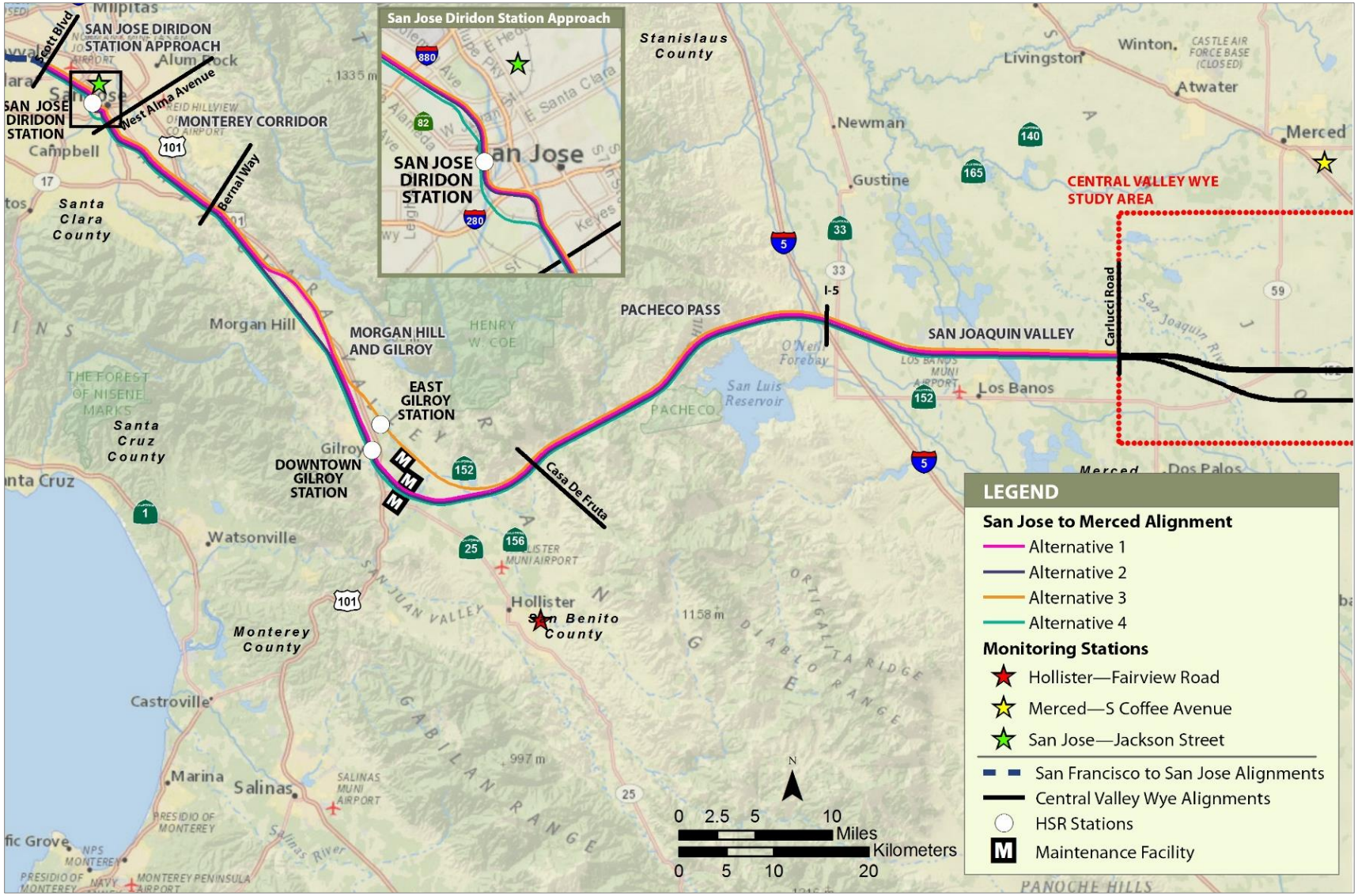
Table 3.3-6 Ambient Criteria Pollutant Concentrations at Air Quality Monitoring Stations along the Project Corridor

Pollutant and Standards	San Jose—Jackson Street			Hollister—Fairview Road			Merced—South Coffee Avenue		
	2015	2016	2017	2015	2016	2017	2015	2016	2017
Ozone (O_3)									
Maximum 1-hour concentration (ppm)	0.094	0.087	0.121	0.079	0.073	0.078	0.102	0.097	0.093
Maximum 8-hour concentration (ppm)	0.081	0.066	0.088	0.065	0.060	0.072	0.089	0.086	0.084
Number of days standard exceeded[1]									
CAAQS 1-hour (>0.09 ppm)	0	0	3	0	0	0	2	2	0
NAAQS 8-hour (>0.070 ppm)	2	0	4	0	0	1	29	28	16
CAAQS 8-hour (>0.070 ppm)	2	0	4	0	0	1	34	29	17
Carbon Monoxide (CO) [b]									
Maximum 8-hour concentration (ppm)	1.8	1.4	1.8	N/A	N/A	N/A	N/A	N/A	N/A
Maximum 1-hour concentration (ppm)	2.4	1.9	2.1	N/A	N/A	N/A	N/A	N/A	N/A
Number of days standard exceeded[1]									
NAAQS 8-hour (≧9 ppm)	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
CAAQS 8-hour (≧9.0 ppm)	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
NAAQS 1-hour (≧35 ppm)	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
CAAQS 1-hour (≧20 ppm)	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
Nitrogen Dioxide (NO_2) [a]									
National maximum 1-hour concentration (ppm)	49.3	51.1	67.5	N/A	N/A	N/A	35.0	35.4	38.9
State maximum 1-hour concentration (ppm)	49	51	67	N/A	N/A	N/A	35	35	38
State annual average concentration (ppm)	12	11	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Number of days standard exceeded[1]									
NAAQS 1-hour (98th Percentile>0.100 ppm)	0	0	0	N/A	N/A	N/A	0	0	0
CAAQS 1-hour (0.18 ppm)	0	0	0	N/A	N/A	N/A	0	0	0

Pollutant and Standards	San Jose—Jackson Street			Hollister—Fairview Road			Merced—South Coffee Avenue		
	2015	2016	2017	2015	2016	2017	2015	2016	2017
Annual standard exceeded?[1]									
NAAQS annual (>0.053 ppm)	No	No	No	N/A	N/A	N/A	No	No	No
CAAQS annual (>0.030 ppm)	No	No	No	N/A	N/A	N/A	No	No	No
Particulate Matter (PM_{10})[2, a]									
National[3] maximum 24-hour concentration (mg/m^3)	58.8	40.0	69.4	65.8	44.3	80.9	N/A	N/A	N/A
National[3] second-highest 24-hour concentration (mg/m^3)	47.2	35.2	67.3	52.5	43.2	74.7	N/A	N/A	N/A
State[4] maximum 24-hour concentration (mg/m^3)	58.0	41.0	69.8	N/A	N/A	N/A	N/A	N/A	N/A
State[4] second-highest 24-hour concentration (mg/m^3)	49.3	37.5	67.6	N/A	N/A	N/A	N/A	N/A	N/A
National annual average concentration (mg/m^3)	21.3	17.5	20.7	17.4	16.5	19.6	NA	NA	NA
State annual average concentration (mg/m^3)[5]	21.9	18.3	21.3	N/A	N/A	N/A	N/A	N/A	N/A
Number of days standard exceeded[1]									
NAAQS 24-hour (>150 mg/m^3)[6]	0	0	0	0	0	0	N/A	N/A	N/A
CAAQS 24-hour (>50 mg/m^3)[6]	3	0	19	N/A	N/A	N/A	N/A	N/A	N/A
Annual standard exceeded?[1]									
CAAQS annual (>20 mg/m^3)	Yes	No	Yes	N/A	N/A	N/A	N/A	N/A	N/A
Particulate Matter ($PM_{2.5}$)[a]									
National[3] maximum 24-hour concentration (mg/m^3)	49.4	22.6	49.7	18.6	20.4	42.0	61.2	43.0	48.2
National[3] second-highest 24-hour concentration (mg/m^3)	37.0	21.8	46.5	14.6	17.2	34.3	55.7	43.0	47.4
State[4] maximum 24-hour concentration (mg/m^3)	49.4	22.7	49.7	18.6	20.4	42.0	61.2	43.0	48.2
State[4] second-highest 24-hour concentration (mg/m^3)	37.0	21.8	46.5	14.6	17.2	34.3	55.7	43.0	47.4
National annual average concentration (mg/m^3)	9.9	8.3	9.5	4.2	4.3	5.0	12.7	11.9	N/A
State annual average concentration (mg/m^3)[5]	10.6	8.4	N/A	4.3	N/A	5.1	N/A	N/A	11.9
Number of days standard exceeded[1]									
NAAQS 24-hour (>35 mg/m^3)	2	0	6	0	0	1	16	5	N/A

Pollutant and Standards	San Jose—Jackson Street			Hollister—Fairview Road			Merced—South Coffee Avenue		
	2015	2016	2017	2015	2016	2017	2015	2016	2017
Annual standard exceeded?[1]									
NAAQS annual (>12.0 mg/m^3)	No	No	No	No	No	No	No	No	N/A
CAAQS annual (>12 mg/m^3)	No	No	No	No	No	No	No	N/A	No
Sulfur Dioxide (SO_2)									
No data available	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Sources: [a] CARB 2018a; [b] USEPA 2018a
[1] An exceedance of a standard is not necessarily a violation because of the regulatory definition of a violation.
[2] National statistics are based on standard conditions data. In addition, national statistics are based on samplers using federal reference or equivalent methods.
[3] State statistics are based on local conditions data.
[4] Measurements usually are collected every 6 days.
[5] State criteria for sufficiently complete data for calculating valid annual averages are more stringent than the national criteria.
[6] Mathematical estimate of how many days' concentrations would have been measured as higher than the level of the standard had each day been monitored. Values have been rounded.
> = greater than
≥ = greater than or equal to
CAAQS = California ambient air quality standards
CO = carbon monoxide
mg/m^3 = milligrams per cubic meter
N/A = not applicable or there was insufficient or no data available to determine the value
NAAQS = national ambient air quality standards
NO_2 = nitrogen dioxide
O_3 = ozone
PM_{10} = particulate matter 10 microns or less in diameter
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
ppm = parts per million
SO_2 = sulfur dioxide



Sources: Authority 2019a; CARB 2018a

MARCH 2019

Figure 3.3-3 Monitoring Station Locations

Table 3.3-7 Federal and State Attainment Status along the Project Corridor within the SFBAAB, NCCAB, and SJVAB

Pollutant	SFBAAB		NCCAB		SJVAB	
	Federal	State	Federal	State	Federal	State
Ozone (O_3)	Nonattainment (marginal)	Nonattainment	Attainment/ Unclassified	Nonattainment-Transitional	Nonattainment (extreme)	Nonattainment
Particulate matter (PM_{10})	Attainment/ Unclassified	Nonattainment	Attainment/ Unclassified	Nonattainment	Maintenance (serious)	Nonattainment
Particulate matter ($PM_{2.5}$)	Nonattainment (moderate)	Nonattainment	Attainment/ Unclassified	Attainment	Nonattainment (serious/moderate[1])	Nonattainment
Carbon monoxide (CO)	Attainment	Attainment	Attainment	Unclassified	Attainment	Unclassified
Nitrogen dioxide (NO_2)	Attainment/ Unclassified	Attainment	Attainment/ Unclassified	Attainment	Attainment/ Unclassified	Attainment
Sulfur dioxide (SO_2)	Attainment/ Unclassified	Attainment	Attainment/ Unclassified	Attainment	Attainment/ Unclassified	Attainment

Sources: CARB 2018b; USEPA 2018b
CO = carbon monoxide
NCCAB = North Central Coast Air Basin
NO_2 = nitrogen dioxide
O_3 = ozone
PM_{10} = particulate matter 10 microns or less in diameter
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
SFBAAB = San Francisco Bay Area Air Basin
SJVAB = San Joaquin Valley Air Basin
SO_2 = sulfur dioxide
[1] The SJVAB is serious nonattainment for the 2006 $PM_{2.5}$ standard and moderate nonattainment for the 2012 $PM_{2.5}$ standard.

Sensitive Receptors

Sensitive receptors are people who have an increased sensitivity to air pollution or environmental contaminants. Sensitive receptor locations include schools, parks and playgrounds, daycare centers, nursing homes, and hospitals. Residential dwellings are also considered sensitive land uses because people can be exposed to pollutants for extended periods. Recreational areas are considered moderately sensitive to poor air quality because vigorous exercise associated with recreation places a high demand on the human respiratory function.

Analyses performed by the CARB indicate that providing a separation of at least 1,000 feet from diesel sources and high-traffic areas would substantially reduce exposure to air contaminants and decrease asthma symptoms in children (CARB 2005). Sensitive receptor locations located within 1,000 feet of the San Jose Diridon Station, Downtown Gilroy Station, East Gilroy Station, and East Gilroy MOWF are shown in Table 3.3-8 and on Figure 3.3-4 through Figure 3.3-7. Sensitive receptor locations located within 1,000 feet of the San Jose Diridon Station, Downtown Gilroy Station, East Gilroy Station, and the East Gilroy MOWF are the same with and without the DDV and TDV. There are no receptors within 1,000 feet of the South Gilroy MOWF. In the RSA, residential land uses are the most common. Other sensitive receptor locations along the corridor include child care/schools, elder care facilities, and parks/recreational facilities.

Table 3.3-8 Sensitive Receptor Locations within 1,000 Feet of the San Jose Diridon and Gilroy Stations and East Gilroy Maintenance of Way Facility

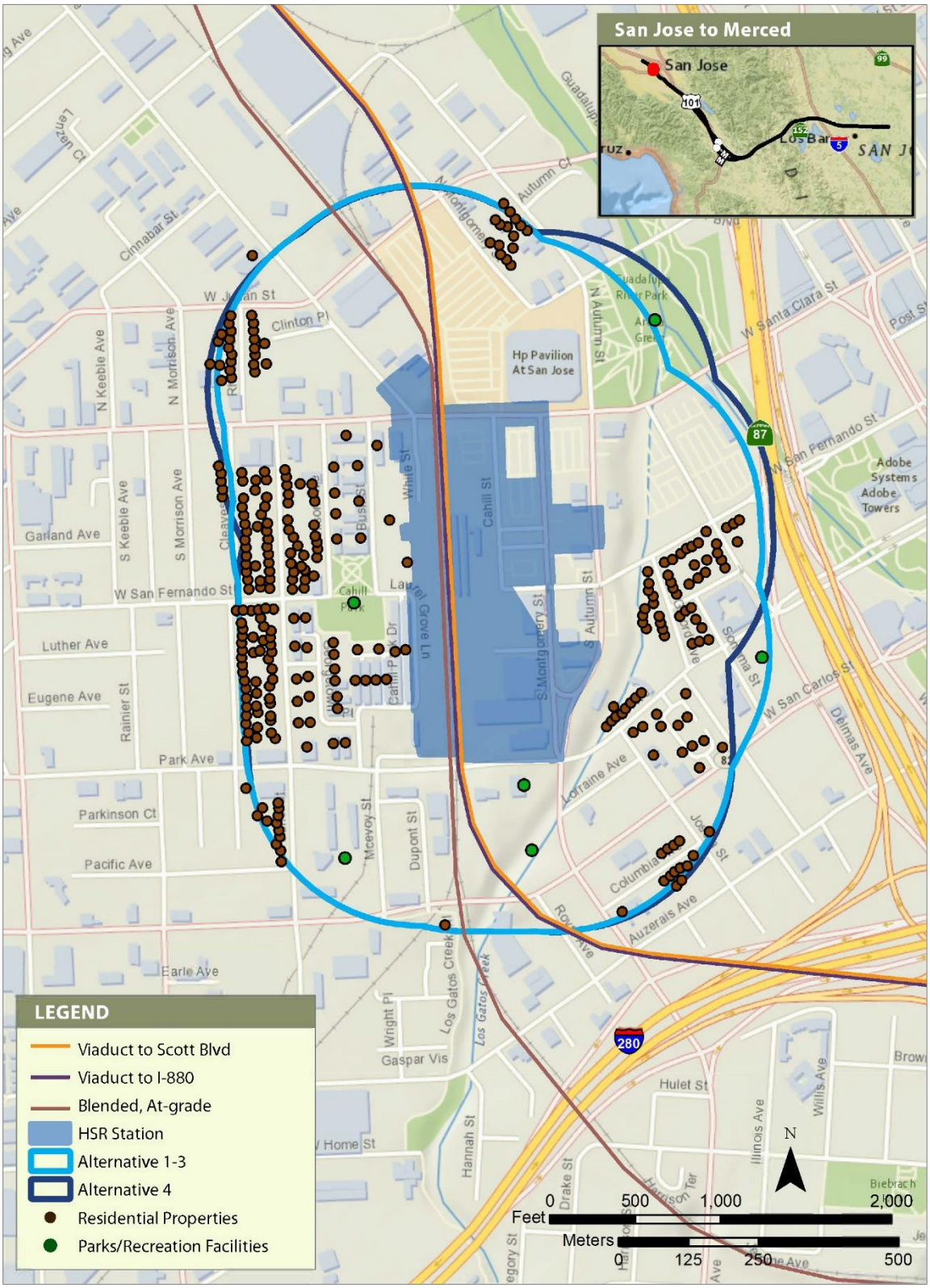
Station and Receptor	Distance from Station (feet)[1]	
San Jose Diridon Station	**Alternatives 1, 2, and 3**	**Alternative 4**
Nearest residential receptor	33	36
Arena Green Park	-	802
Cahill Park	325	326
Planned community park	144	144
Discovery Dog Park	957	-
Los Gatos Creek Trail	527	527
Sunol Community Day School play area (school is closed but grass and blacktop remain)	745	745
Downtown Gilroy Station	**Alternatives 1 and 2**	**Alternative 4**
Nearest residential receptor	17	41
Elliot Elementary School (play area)	839	939
Forest Street Park	244	362
Wheeler Tot Lot	826	816
Elliot Elementary School	703	804
Miranda's Residential Care Home	934	971

Station and Receptor	Distance from Station (feet)[1]
East Gilroy Station	**Alternative 3**
Nearest residential receptor	21
East Gilroy Maintenance of Way Facility[2]	**Alternative 3**
Nearest residential receptor	90
Pacific Point Christian School play yard	775
Pacific Point Christian School	463

Sources: Authority 2019a; CPAD 2016

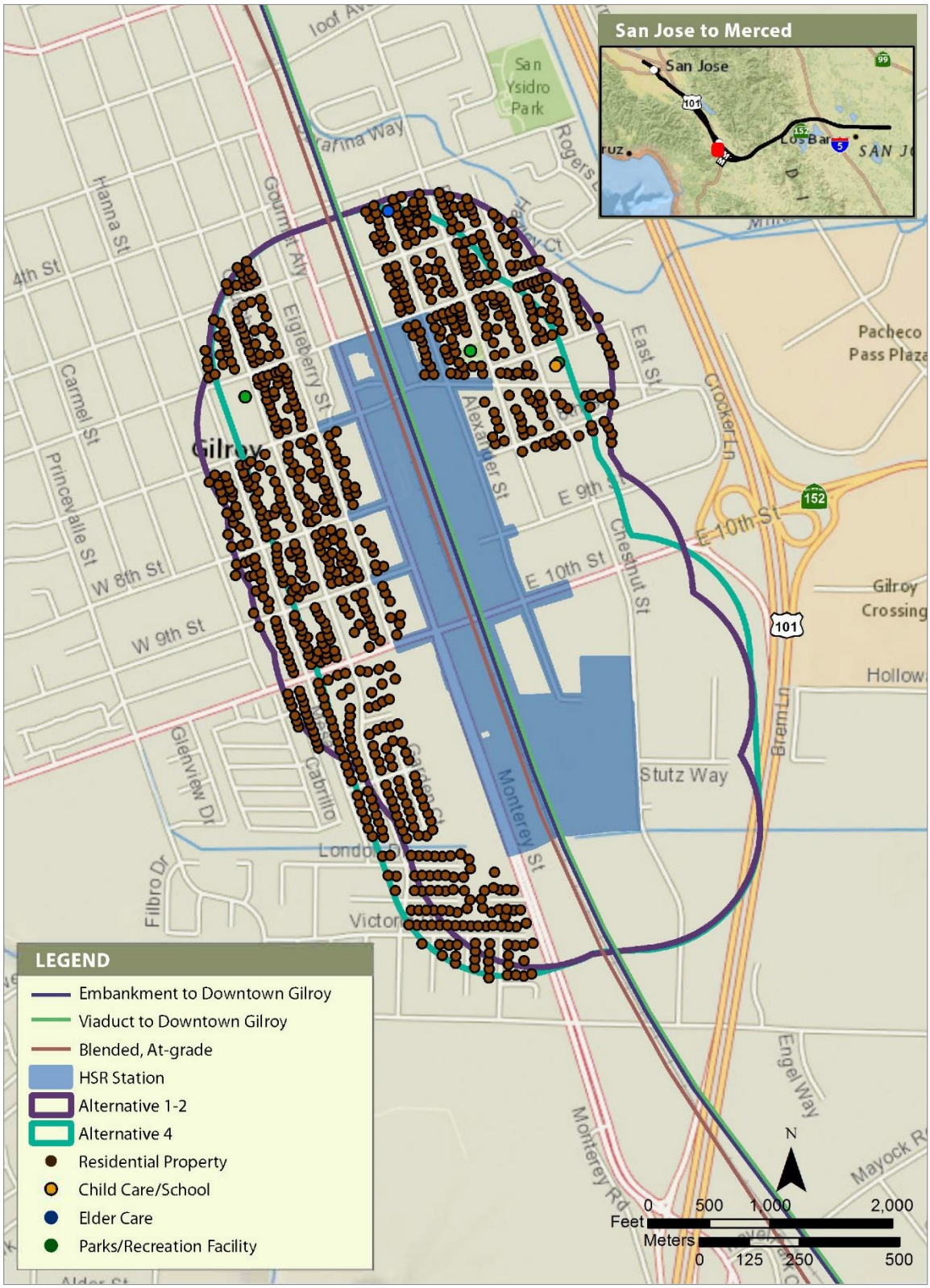
[1] Distance measured from the receptor to the closest edge of the temporary construction areas associated with the stations, as shown in Figure 3.3-4 through Figure 3.3-7.

[2] There are no sensitive receptors within 1,000 feet of the South Gilroy maintenance of way facility.



Sources: Authority 2019a; CPAD 2016; Google Inc. 2018 JUNE 2019

Figure 3.3-4 Sensitive Receptor Locations within 1,000 Feet of the San Jose Diridon Station

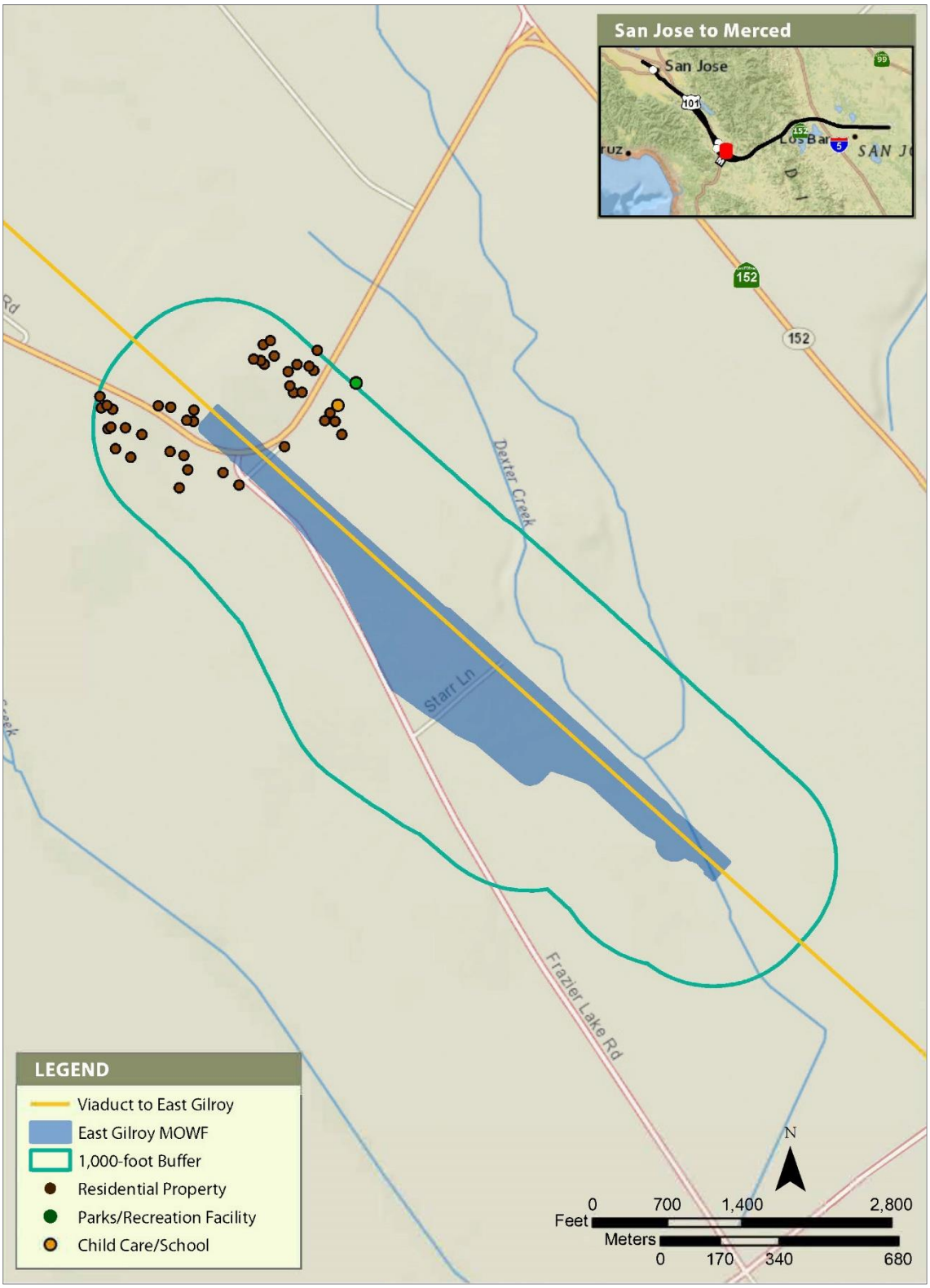


Sources: Authority 2019a; CPAD 2016; Google Inc. 2018 JUNE 2019

Figure 3.3-5 Sensitive Receptor Locations within 1,000 Feet of the Downtown Gilroy Station

Sources: Authority 2019a; CPAD 2016; Google Inc. 2018 JUNE 2019

Figure 3.3-6 Sensitive Receptor Locations within 1,000 Feet of the East Gilroy Station



Sources: Authority 2019a; CPAD 2016; Google Inc. 2018

OCTOBER 2019

Figure 3.3-7 Sensitive Receptor Locations within 1,000 Feet of the East Gilroy Maintenance of Way Facility

Air Quality Plans

As discussed in Section 3.3.2.3, Regional and Local, the CARB and local air districts within the RSA have prepared SIPs that describe how areas will attain NAAQS, where applicable. Table 3.3-9 summarizes the status of each SIP relevant to the RSA.

Table 3.3-9 State Implementation Plans

Plan	Status
2001 San Francisco Bay Area Ozone Attainment Plan for the 1-Hour National Ozone Standard	In a March 30, 2001, Fed. Reg. notice (66 Fed. Reg. 17379), USEPA proposed to make a finding that the Bay Area has not attained the national 1-hour O_3 standard. USEPA proposed partial approval and partial disapproval of the 1999 Ozone Attainment Plan. On August 28, 2001, USEPA took final action on its March 2001 notice, triggering a CAA requirement that a new plan be submitted within 1 year of the effective date of USEPA's final action. The revised 2001 Ozone Attainment Plan included the necessary changes to address the USEPA's disapproval of the prior plan. In addition, to address the requirements triggered by the USEPA's finding of failure to attain, the plan included a new emissions inventory and commitments to adopt and implement additional control measures to attain the standard by 2006, the attainment deadline. It also included additional contingency measures in the event the Bay Area did not attain the standard by 2006.
2017 Clean Air Plan	Although not a federal planning document, the Bay Area 2017 Spare the Air, Cool the Climate (Clean Air Plan) provided a comprehensive plan to improve Bay Area air quality and protect public health. The Clean Air Plan defined a control strategy that the BAAQMD and its partners is implementing to: (1) attain all state and national ambient air quality standards; (2) eliminate disparities among Bay Area communities in cancer health risk from toxic air contaminants; and (3) reduce GHG emissions to protect the climate.
2005 Report on Attainment of the California Particulate Matter Standards in the Monterey Bay Region	Although not a federal planning document, the plan fulfilled the requirements of Senate Bill 656 to reduce public exposure to PM. The plan outlines readily available, feasible, and cost-effective control measures for PM within the MBARD.
2007 Federal Maintenance Plan for Maintaining the National Ozone Standard in the Monterey Bay Region	This plan presents the strategy for maintaining the NAAQS for O_3 in the NCCAB. The NCCAB attained the 8-hour NAAQS in 2014.
2012–2015 Air Quality Management Plan	Although not a federal planning document, the Air Quality Management Plan is prepared triennially by the MBARD to document the region's continued progress toward meeting the state 8-hour O_3 standard.
2007 PM_{10} Maintenance Plan and Request for Redesignation	On September 25, 2008, USEPA redesignated the San Joaquin Valley to attainment for the PM_{10} NAAQS and approved the 2007 PM_{10} Maintenance Plan.

Plan	Status
2007 8-Hour Ozone Plan	On May 5, 2010, USEPA reclassified the 8-hour O_3 nonattainment status of the San Joaquin Valley from "serious" to "extreme." The reclassification required the state to incorporate more stringent requirements, such as lower permitting thresholds, and implement reasonably available control technologies at more sources. The 2007 8-hour Ozone Plan contained a comprehensive and exhaustive list of regulatory and incentive-based measures to reduce emissions of O_3 and PM precursors throughout the San Joaquin Valley. On December 18, 2007, the SJVAPCD Governing Board adopted the plan with an amendment to extend the rule adoption schedule for organic waste operations. On January 8, 2009, USEPA found that the motor vehicle budgets for 2008, 2020, and 2030 from the 2007 8-hour Ozone Plan were not adequate for transportation conformity purposes. The next plan will address USEPA's 2008 8-hour O_3 standard of 75 parts per billion.
2013 Plan for the Revoked 1-Hour Ozone Standard	On September 19, 2013, USEPA approved the San Joaquin Valley's 2013 Plan for the Revoked 1-Hour Ozone Standard. Effective June 15, 2005, USEPA revoked the federal 1-hour O_3 standard for areas including the SJVAB.
2015 Plan for the 1997 $PM_{2.5}$ Standard	On April 30, 2008, the SJVAPCD adopted the 2008 $PM_{2.5}$ Plan, satisfying all federal implementation requirements for the 1997 federal $PM_{2.5}$ standard. Per guidance from USEPA, the plan addressed the 1997 $PM_{2.5}$ standard under Subpart 1 of federal CAA Title 1, Part D (Subpart 1). Subsequently, in 2013, the U.S. Court of Appeals for the District of Columbia Circuit ruled that USEPA erred by solely using CAA Subpart 1 in establishing its $PM_{2.5}$ implementation rule, without consideration of the PM-specific provisions in CAA Title 1, Part D, Subpart 4 (Subpart 4). In June 2014, USEPA classified the SJVAB as a "moderate" nonattainment area under Subpart 4. USEPA recently reclassified the Valley as "serious" nonattainment effective May 7, 2015. The 2015 $PM_{2.5}$ Plan addresses the federal mandates for a "serious" nonattainment area related to the 1997 $PM_{2.5}$ standard.
2016 Moderate Area Plan for the 2012 $PM_{2.5}$ Standard	The 2016 Moderate Area Plan addresses the federal mandates for areas classified as "moderate" nonattainment for the 2012 $PM_{2.5}$ federal annual air quality standard of 12 micrograms per cubic meter
2016 Plan for the 2008 8-Hour Ozone Standard[1]	The SJVAPCD adopted the 2016 Plan for the 2008 8-Hour Ozone Standard in June 2016. This plan satisfies CAA requirements and provides for expeditious attainment of the 75 parts per billion 8-hour O_3 standard.
2018 $PM_{2.5}$ Plan	The 2018 $PM_{2.5}$ Plan provides a single integrated plan to attain the federal health-based 1997, 2006, and 2012 NAAQS. The plan builds upon comprehensive strategies already in place from previously adopted SJVAPCD attainment plans and measures.

Sources: BAAQMD 2001, 2017b; MBUAPCD 2005, 2007, 2017; SJVAPCD 2007a, 2007b, 2013, 2015b, 2016a, 2016b, 2018

BAAQMD = Bay Area Air Quality Management District
Bay Area = San Francisco Bay Area
CAA = Clean Air Act
Fed. Reg. = *Federal Register*
GHG = greenhouse gases
MBARD = Monterey Bay Air Resources District
NAAQS = national ambient air quality standards
NCCAB = North Central Coast Air Basin
O_3 = ozone
PM_{10} = particulate matter 10 microns or less in diameter
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
SJVAPCD = San Joaquin Valley Air Pollution Control District
USEPA = U.S. Environmental Protection Agency

Emissions Inventory

An emissions inventory is an accounting of the total emissions from all sources in a geographic area over a specified time period. Emission inventories are used in air quality planning and can provide a general indication of existing air quality in an area.

The CARB maintains an annual emission inventory for each county and air basin in the state. The inventories for Santa Clara, San Benito, and Merced Counties consist of data submitted to the CARB by the local air districts, plus estimates for certain source categories, which are provided by CARB staff. Based on the 2012 air pollutant inventory data, except for San Benito County, mobile source emissions represent most of the VOC, NO_X, and CO emissions. In San Benito County, area sources represent most VOC emissions, and mobile source emissions represent the majority of NO_X and CO. Area sources represent the majority of PM_{10} and $PM_{2.5}$ emissions in all three counties.

3.3.5.2 Greenhouse Gases

The CARB (2018c) maintains a statewide emissions inventory of GHGs. In 2016, the largest contributor to GHG emissions was the transportation sector (41 percent). This sector includes emissions from on-road vehicles, intrastate aviation, waterborne vessels, and rail operations. The next largest contributor to emissions was the industrial sector (23 percent), followed by electricity generations (in-state and imports).

3.3.6 Environmental Consequences

This section discusses the potential impacts on air quality and climate change that could result from the No Project Alternative and implementing the project alternatives. It is organized by topic: violations of ambient air quality standards and conflicts with air quality attainment plans within each air basin (SFBAAB, NCCAB, and SJVAB), followed by potential exposure of receptors to increased health risks and odors. Construction-related emissions are presented first followed by emissions during long-term operations.

3.3.6.1 Air Quality

Project construction and operations could result in temporary and permanent impacts on air quality. The types of impacts analyzed in this section include the potential degradation of air quality in the SFBAAB, NCCAB, and SJVAB; exposure of sensitive receptors to pollutant concentrations; and elevated health risks.

No Project Impacts

The population of the Bay Area and San Joaquin Valley is expected to grow through 2040 (Section 2.6.1.1, Projections Used in Planning). The population in the San Joaquin Valley is projected to grow at a higher rate than any other region in California. Development in the Bay Area and San Joaquin Valley to accommodate the population increase would continue under the No Project Alternative and result in associated direct and indirect impacts on air quality and GHGs. The No Project Alternative considers the impacts of conditions forecasted by current plans for land use and transportation near the project, including planned improvements to the highway, aviation, conventional passenger rail, freight rail, and port systems through the 2040 planning horizon for the environmental analysis if the project is not built. Without the project, the regional VMT would be higher, resulting in increased pressure to improve capacity for all transportation modes throughout the area. The Authority estimates that additional highway and airport projects (up to 4,300 highway lane miles, 115 airport gates, and 4 airport runways) would be planned and constructed to achieve equivalent capacity and relieve this increased pressure (Authority 2012). Planned and other reasonably foreseeable projects anticipated to be built by 2040 would include residential, commercial, industrial, recreational, and transportation projects, all of which could contribute to regional air quality conditions. A full list of anticipated future development projects is provided in Volume 2 in Appendix 3.19-A, Nontransportation Plans and Projects, and Appendix 3.19-B, Transportation Plans and Projects.

The anticipated improvements in emissions efficiency for on-road vehicles and aircraft in the future have been incorporated into the No Project Alternative analysis. Additionally, because of the state requirement that an increasing fraction (60 percent by 2030) of electricity generated for the state's power portfolio come from renewable energy sources, it is likely that future emissions from power plant sources would be lower than the emissions estimated for this analysis, which is based on the state's existing mix of renewable and nonrenewable sources.

Table 3.3-10 and Table 3.3-11 summarize estimated emissions under the No Project Alternative in 2015, 2029, and 2040, which correlate with assumptions under the medium and high ridership scenarios, respectively. As shown in the tables, total emissions for some pollutants would decrease from 2015 to 2040 (VOC, CO, and NO_X). For other pollutants (SO_2, PM_{10}, and $PM_{2.5}$), total emissions would increase from 2015 to 2040. The increase in PM would be primarily a result of higher VMT, aircraft, and electricity demand brought about by population and economic growth. The increase in SO_2 would be primarily related to growth in air travel and power plant production. The decrease in other pollutants would result from expected improvements in on-road vehicle engine technology, fuel efficiency, and turnover in older, more heavily polluting vehicles, which would offset emissions increases from higher on-road VMT and aircraft and power plant activity.

Table 3.3-10 Estimated Statewide Emissions, No Project Alternative: Medium Ridership Scenario

Emission Source	VOC (tons/yr)	CO (tons/yr)	NO_X (tons/yr)	SO_2 (tons/yr)	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)
2015						
On-road vehicles	7,839	324,144	33,370	767	22,981	6,242
Aircraft	338	2,888	2,779	299	84	84
Power plants	1,893	25,767	13,476	1,609	3,189	2,880
Total statewide emissions	10,070	352,800	49,624	2,675	26,254	9,206
2029						
On-road vehicles	1,712	125,365	9,783	577	26,322	6,998
Aircraft	411	3,445	3,391	367	103	102
Power plants	2,310	34,760	14,890	1,936	3,807	3,442
Total statewide emissions	4,434	163,570	28,064	2,880	30,232	10,542
2040						
On-road vehicles	1,059	91,121	6,688	534	28,262	7,383
Aircraft	474	3,968	3,908	423	118	118
Power plants	2,579	39,173	16,080	2,104	4,082	3,686
Total statewide emissions	4,112	134,261	26,676	3,062	32,463	11,187

Source: Authority 2020
Totals may not add up exactly because of rounding.
CO = carbon monoxide
NO_X = nitrogen oxide
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
PM_{10} = particulate matter 10 microns or less in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compound
yr = year

Table 3.3-11 Estimated Statewide Emissions, No Project Alternative: High Ridership Scenario

Emission Source	VOC (tons/yr)	CO (tons/yr)	NO_X (tons/yr)	SO_2 (tons/yr)	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)
2015						
On-road vehicles	7,800	322,534	33,204	763	22,867	6,211
Aircraft	315	2,692	2,589	279	78	78
Power plants	1,893	25,767	13,476	1,609	3,189	2,880
Total statewide emissions	10,008	350,993	49,269	2,651	26,134	9,170
2029						
On-road vehicles	1,725	126,531	9,983	590	26,898	7,147
Aircraft	341	2,856	2,811	304	85	85
Power plants	2,310	34,760	14,890	1,936	3,807	3,442
Total statewide emissions	4,377	164,146	27,684	2,830	30,789	10,674
2040						
On-road vehicles	1,093	94,097	6,907	552	29,185	7,625
Aircraft	520	4,348	4,282	464	129	129
Power plants	2,579	39,173	16,080	2,104	4,082	3,686
Total statewide emissions	4,192	137,618	27,269	3,120	33,397	11,440

Source: Authority 2020
Totals may not add up exactly because of rounding.
CO = carbon monoxide
NO_X = nitrogen oxide
PM_{10} = particulate matter 10 microns or less in diameter
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compound
yr = year

Project Impacts

Construction Impacts

Project construction would include earthworks and excavation support, tunnel, bridge and aerial structure construction, station construction, track work, and railway systems construction. Chapter 2, Alternatives, provides detailed descriptions of construction activities.

Impact AQ#1: Temporary Direct and Indirect Impacts on Air Quality within the SFBAAB

The predominant pollutants associated with project construction are fugitive dust (PM_{10} and $PM_{2.5}$) from earthmoving activities and combustion pollutants, particularly O_3 precursors (NO_X and VOC) and CO from heavy equipment and trucks. VOCs would also be generated from paints and other coatings used during construction activities.

Table 3.3-12 presents construction emissions from Alternatives 1 through 4 in the SFBAAB in tons per year and pounds per day. The table reflects the impact of the SAFE Vehicle Rule (CARB 2019a). Exceedances of General Conformity *de minimis* levels and BAAQMD CEQA thresholds are shown in bolded underline with an asterisk (*). The emissions calculations incorporate the following air quality IAMFs.

- AQ-IAMF#1 will minimize fugitive dust emissions through the implementation of a dust control plan. The fugitive dust control plan will outline measures such as washing vehicles before exiting the construction site, watering unpaved surfaces, limiting vehicle travel speed, and suspending dust-generating activities during high wind events.
- AQ-IAMF#2 will minimize off-gassing emissions of VOCs that will occur from paints and other coatings by requiring the use of low-VOC paint and super-compliant or Clean Air paint that has a lower VOC content than that required by air district rules.
- AQ-IAMF#3 will minimize exhaust emissions from off-road equipment with renewable diesel. Renewable diesel is produced from non-petroleum renewable resources and waste products and generates substantially fewer emissions than traditional diesel per gallon combusted.
- AQ-IAMF#4 will minimize exhaust emissions from off-road equipment by requiring all heavy-duty equipment used during the construction phase to meet Tier 4 engine requirements. Tier 4 engine requirements are currently the strictest emissions standards adopted by the CARB and USEPA.
- AQ-IAMF#5 will minimize exhaust emissions from on-road trucks by requiring all trucks used to haul construction materials to operate a model year 2010 engine or newer.
- AQ-IAMF#6 will minimize fugitive dust emissions from concrete batching through implementation of typical control measures, such as water sprays, enclosures, hoods, and other suitable technology.

Even with incorporation of project features (IAMFs), the project will result in a temporary impact on regional air quality during construction because increased VOC and NO_X emissions will exceed the BAAQMD's CEQA thresholds. NO_X emissions would also exceed the General Conformity *de minimis* threshold for all four project alternatives.

The BAAQMD's thresholds were established to prevent emissions from new projects in the SFBAAB from contributing to CAAQS or NAAQS violations. Since construction emissions of VOC and NO_X would exceed these thresholds, the project would contribute a significant level of regional air pollution within the SFBAAB. Moreover, project construction may conflict with the *2001 San Francisco Bay Area Ozone Attainment Plan for the 1-Hour National Ozone Standard* (BAAQMD 2001) or 2017 Clean Air Plan (BAAQMD 2017b), which were adopted to achieve regional attainment with the ambient air quality standards. Certain individuals residing in areas that do not meet the CAAQS or NAAQS, including the SFBAAB, could be exposed to pollutant concentrations that cause or aggravate acute and/or chronic health conditions (e.g., asthma, lost work days, premature mortality). While construction of the project would contribute to existing and future air pollution, average daily project-generated emissions represent approximately 0.01 percent and 0.10 percent of SFBAAB VOC and NOx emissions (2015 est.), respectively (BAAQMD 2017b). As previously discussed, the magnitude and locations of any potential changes in ambient air quality, and thus health consequences, from these additional emissions cannot be quantified with a high level of certainty due to the dynamic and complex nature of ozone formation and distribution (e.g., meteorology, emissions sources, sunlight exposure). Similar limitations exist for precisely modeling project-level health consequences of directly emitted PM. However, it is known that public health would continue to be affected in SFBAAB so long as the region does not attain the CAAQS or NAAQS.

This Page Intentionally Left Blank

Table 3.3-12 Construction-Related Criteria Pollutant Emissions in the San Francisco Bay Area Air Basin[1]

	Tons per year										Maximum Pounds per day[3]									
					PM_{10}			$PM_{2.5}$							PM_{10}			$PM_{2.5}$		
Year[2]	VOC	NO_X	CO	SO_2	Exhaust	Dust	Total[4]	Exhaust	Dust	Total[4]	VOC	NO_X	CO	SO_2	Exhaust	Dust	Total[4]	Exhaust	Dust	Total[4]
Alternative 1																				
2022	4	50	145	<1	<1	28	28	<1	6	6	42	**624 ***	1,396	5	4	308	312	4	66	70
2023	6	79	200	1	1	46	46	1	10	10	**63 ***	**967 ***	2,216	7	6	590	596	6	128	134
2024	7	**106 ***	245	1	1	65	66	1	14	15	**61 ***	**961 ***	2,154	7	6	580	586	6	126	131
2025	6	85	205	1	1	48	49	1	10	11	**64 ***	**1,158 ***	2,025	7	10	537	542	10	111	116
2026	3	37	89	<1	<1	18	18	<1	4	4	32	**369 ***	1,146	3	3	197	200	3	42	45
2027	2	35	53	<1	<1	12	12	<1	2	3	41	**375 ***	546	8	12	120	123	12	25	33
2028	1	11	28	<1	<1	3	3	<1	1	1	33	**330 ***	707	7	10	108	112	10	23	27
Applicable *de minimis* level[5]	100	100	-	100	-	-	-	-	-	100	-	-	-	-	-	-	-	-	-	-
BAAQMD CEQA threshold	-	-	-	-	-	-	-	-	-	-	54	54	-	-	82	-	-	54	-	-
Alternative 2																				
2022	6	76	192	1	1	41	41	1	9	10	54	**773***	1,770	5	5	417	422	5	94	98
2023	7	**118 ***	255	1	1	67	67	1	15	16	**77 ***	**1,334 ***	2,630	8	7	779	787	7	177	184
2024	9	**155 ***	304	1	1	92	93	1	21	21	**75 ***	**1,325 ***	2,558	8	7	768	775	7	174	181
2025	7	**112 ***	241	1	1	62	63	1	14	15	**76 ***	**1,334 ***	2,367	8	10	721	727	9	160	166
2026	4	56	125	<1	<1	28	29	<1	6	7	42	**564 ***	1,496	4	4	294	298	4	66	70
2027	3	69	77	<1	<1	28	29	<1	5	6	50	**750 ***	807	9	13	282	290	13	54	65
2028	1	14	38	<1	<1	4	5	<1	1	1	35	**711 ***	1,052	8	10	286	291	10	56	61
Applicable *de minimis* level[5]	100	100	-	100	-	-	-	-	-	100	-	-	-	-	-	-	-	-	-	-
BAAQMD CEQA threshold	-	-	-	-	-	-	-	-	-	-	54	54	-	-	82	-	-	54	-	-
Alternative 3																				
2022	5	51	173	0	<1	27	27	<1	6	6	46	**514 ***	1,602	4	4	277	281	4	59	63
2023	7	89	244	1	1	49	50	1	11	11	**73 ***	**1,021 ***	2,586	8	7	616	623	7	135	141
2024	8	**114 ***	293	1	1	68	69	1	15	15	**71 ***	**1,012 ***	2,511	8	7	602	609	6	131	138
2025	7	85	233	1	1	47	47	1	10	11	**73 ***	**1,064 ***	2,377	7	9	555	561	9	116	122
2026	3	41	116	<1	<1	19	19	<1	4	4	39	**415 ***	1,406	4	4	205	209	4	44	48
2027	2	41	55	<1	<1	15	15	<1	3	3	42	**444 ***	573	8	12	138	145	12	28	38
2028	1	12	30	<1	<1	3	4	<1	1	1	33	**426 ***	777	8	10	150	154	10	31	35
Applicable *de minimis* level[5]	100	100	-	100	-	-	-	-	-	100	-	-	-	-	-	-	-	-	-	-
BAAQMD CEQA threshold	-	-	-	-	-	-	-	-	-	-	54	54	-	-	82	-	-	54	-	-

Year[2]	Tons per year										Maximum Pounds per day[3]									
					PM_{10}			$PM_{2.5}$							PM_{10}			$PM_{2.5}$		
	VOC	NO_X	CO	SO_2	Exhaust	Dust	Total[4]	Exhaust	Dust	Total[4]	VOC	NO_X	CO	SO_2	Exhaust	Dust	Total[4]	Exhaust	Dust	Total[4]
Alternative 4																				
2022	5	77	177	1	<1	47	47	<1	11	11	52	**787 ***	1,692	5	4	484	489	4	112	116
2023	7	**113 ***	222	1	1	69	70	1	16	17	**64 ***	**1,191 ***	2,137	7	6	727	732	6	170	176
2024	8	**156 ***	272	1	1	95	95	1	22	23	**74 ***	**1,363 ***	2,358	8	7	824	831	7	188	195
2025	7	**139 ***	241	1	1	79	79	1	18	19	**74 ***	**1,731 ***	2,220	9	13	798	804	12	181	187
2026	3	62	109	<1	<1	34	34	<1	8	8	42	**686 ***	1,442	4	4	392	396	4	90	94
2027	3	84	70	<1	<1	37	37	<1	7	7	45	**900 ***	997	9	12	378	383	12	72	79
2028	1	13	29	<1	<1	5	5	<1	1	1	31	**754 ***	743	7	10	341	344	10	65	68
Applicable *de minimis* level[5]	100	100	-	100	-	-	-	-	-	100	-	-	-	-	-	-	-	-	-	-
BAAQMD CEQA threshold	-	-	-	-	-	-	-	-	-	-	54	54	-	-	82	-	-	54	-	-

[1] Emissions results include implementation of AQ-IAMF#1 through AQ-IAMF#6. Exceedances of *de minimis* levels and BAAQMD CEQA thresholds are shown in **bolded underline with an asterisk (*)**.
[2] The analysis assumed that project construction would take place from 2022 to 2028. As construction is expected to take place later than these dates, the construction emissions estimates are conservative, as future emissions rates will be lower due to the implementation of cleaner and newer equipment.
[3] Presents the highest emissions estimate during a single day of construction in each year, based on concurrent construction activities.
[4] Total PM_{10} and $PM_{2.5}$ emissions consist of exhaust and fugitive dust emissions. Annual values may not add due to rounding. Daily results may not add because the table presents maximum emissions results for each individual pollutant component. For example, the maximum PM exhaust emissions may not occur on the same day as the maximum total dust emissions.
[5] The General Conformity *de minimis* thresholds for criteria pollutants are based on the federal attainment status of the project vicinity in the SFBAAB. The project vicinity is considered a marginal nonattainment area for the O_3 NAAQS and a moderate nonattainment area for the $PM_{2.5}$ NAAQS. Although the project vicinity is in attainment for SO_2, because SO_2 is a precursor for $PM_{2.5}$, the $PM_{2.5}$ General Conformity *de minimis* thresholds are used.
- = no threshold
< = less than
BAAQMD = Bay Area Air Quality Management District
CEQA = California Environmental Quality Act
CO = carbon monoxide
IAMF = impact avoidance and minimization feature
NAAQS = national ambient air quality standards
NO_X = nitrogen oxide
O_3 = ozone
PM_{10} = particulate matter 10 microns or less in diameter
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
SFBAAB = San Francisco Bay Area Air Basin
SO_2 = sulfur dioxide
VOC = volatile organic compound

Alternatives 2 and 4 would result in comparable levels of total emissions, and Alternatives 1 and 3 would result in comparable levels of total emissions. Alternatives 2 and 4 would result in the greatest emissions primarily because of embankment activities in the Morgan Hill and Gilroy Subsection, in contrast to viaduct construction under Alternatives 1 and 3, which would require less earthmoving (e.g., excavation) and heavy-duty equipment and vehicles. The amount of construction effort for the design variants would be approximately the same as the alternatives without the DDV and TDV and thus the amount of construction period criteria pollutant emissions would be approximately the same. Maximum daily VOC and NO_X emissions in excess of BAAQMD thresholds would be generated between 2023 and 2025, with the greatest daily emissions occurring in 2025 under all project alternatives. Daily VOC and NO_X emissions would be highest in 2025 because of concurrent construction activities in the Morgan Hill and Gilroy Subsection and ballast hauling. Construction and emissions intensity would decline after 2025 after earthmoving and other equipment-intensive activities are complete.

The BAAQMD does not have mass emission CEQA thresholds for total PM, CO, or SO_2; localized air quality and public health impacts from these pollutants are evaluated based on the air dispersion modeling of ambient air concentrations. Impact AQ#5 discusses the conclusions of the modeled ambient air concentrations. None of the federal *de minimis* thresholds would be exceeded during construction.

CEQA Conclusion

The impact would be significant under CEQA for all four project alternatives because construction could result in temporary exceedance of BAAQMD's VOC and NO_X thresholds. Project features (AQ-IAMF#1 through AQ-IAMF#6) will minimize air quality impacts through application of all best available on-site controls to reduce construction emissions. However, even with these features, exceedances of BAAQMD's VOC and NO_X thresholds will still occur and the project will contribute a significant level of regional VOC and NO_X pollution within the SFBAAB. Mitigation measures to address this impact are identified in Section 3.3.9, CEQA Significance Conclusions. Section 3.3.7, Mitigation Measures, describes these measures in detail.

Impact AQ#2: Temporary Direct and Indirect Impacts on Air Quality within the NCCAB

Pollutants generated by construction activities within the NCCAB would be similar to those generated within the SFBAAB, as described under Impact AQ#1. The project will minimize impacts associated with fugitive dust emissions through implementation of a dust control plan (AQ-IAMF#1). Exhaust-related pollutants will be minimized through use of renewable diesel, Tier 4 off-road engines, and model year 2010 or newer on-road engines, as required by AQ-IAMF#3 through AQ-IAMF#5. No architectural coatings would be required within the NCCAB and no temporary batch plant would be operated, and as such, AQ-IAMF#2 and AQ-IAMF#6 do not apply.

Table 3.3-13 presents construction emissions from Alternatives 1 through 4 in the NCCAB in tons per year and pounds per day and includes AQ-IAMF#1 and AQ-IAMF#3 through AQ-IAMF#5. The table reflects the impact of the SAFE Vehicle Rule (CARB 2019a). Exceedances of MBARD CEQA thresholds are shown in bolded underline with an asterisk (*). There are no applicable General Conformity *de minimis* thresholds because the NCCAB is considered in attainment for all criteria pollutants; therefore, a general conformity analysis is not required.

None of the project alternatives would result in construction emissions above MBARD's PM_{10} threshold.

The MBARD's PM_{10} threshold was established to prevent emissions from new projects in the NCCAB from contributing to CAAQS or NAAQS violations. Since construction-related PM_{10} emissions would not exceed this threshold, the project alternatives would not contribute a significant level of regional PM pollution within the NCCAB. Moreover, none of the project alternatives would conflict with the *Report on Attainment of the California Particulate Matter Standards in the Monterey Bay Region* (MBUAPCD 2005), which was adopted to achieve regional attainment with the ambient air quality standards. Certain individuals residing in areas that do not meet the PM_{10} CAAQS could be exposed to pollutant concentrations that cause or aggravate acute and/or chronic health conditions (e.g., asthma, lost work days, premature mortality). While project construction would contribute to existing and future air pollution, average daily project-generated emissions represent approximately 0.04 percent of NCCAB PM_{10} emissions (2012 est.) (CARB 2017). As previously discussed, the magnitude and locations of any potential changes in ambient air quality, and thus health consequences, from these additional emissions cannot be quantified with a high level of certainty due to the dynamic and complex nature of regional PM distribution (e.g., meteorology, emissions sources). However, it is known that public health would continue to be affected in NCCAB so long as the region does not attain the PM_{10} CAAQS.

Total annual emissions are highest under Alternatives 2 and 4 because of embankment activities in the Morgan Hill and Gilroy Subsection and more movement of ballast through the NCCAB. Embankment construction generally requires more equipment and vehicles than viaduct construction, resulting in greater emissions. In addition, berm and embankment construction requires more ballast, which results in more ballast hauling and associated emissions. In general, emissions under all alternatives would be greatest during the first few years of construction when earthmoving and other emissions-intensive activities would occur. Emissions would peak again in 2027 and 2028 due to ballast hauling through the NCCAB.

The MBARD does not have mass emission CEQA thresholds for other criteria pollutants; localized air quality and public health impacts from these pollutants are evaluated based on the air dispersion modeling of ambient air concentrations. Impact AQ#5 discusses the conclusions of the modeled ambient air concentrations.

CEQA Conclusion

The impact would be less than significant for all project alternatives because emissions would not exceed MBARD's PM_{10} threshold. As such, the project alternatives would not contribute a significant level of PM_{10} pollution such that regional air quality within the NCCAB would be degraded. Therefore, CEQA does not require mitigation.

Table 3.3-13 Construction-Related Criteria Pollutant Emissions in the North Central Coast Air Basin by Alternative[1]

	Tons per year										Maximum Pounds per day[3]									
					PM_{10}			$PM_{2.5}$							PM_{10}			$PM_{2.5}$		
Year[2]	VOC	NO_X	CO	SO_2	Exhaust	Dust	Total[4]	Exhaust	Dust	Total[4]	VOC	NO_X	CO	SO_2	Exhaust	Dust	Total[4]	Exhaust	Dust	Total[4]
Alternative 1																				
2022	1	7	17	<1	<1	4	4	<1	1	1	5	93	176	1	1	46	46	1	10	10
2023	1	6	19	<1	<1	4	4	<1	1	1	4	66	157	<1	<1	39	39	<1	8	8
2024	<1	5	18	<1	<1	3	3	<1	1	1	4	43	148	<1	<1	29	29	<1	6	7
2025	<1	4	15	<1	<1	3	3	<1	1	1	4	55	136	<1	<1	27	27	<1	6	6
2026	<1	2	10	<1	<1	2	2	<1	<1	<1	3	28	105	<1	<1	19	20	<1	4	5
2027	<1	3	6	<1	<1	1	1	<1	<1	<1	2	69	67	<1	<1	16	16	<1	4	4
2028	<1	1	3	<1	<1	<1	<1	<1	<1	<1	3	48	94	<1	<1	15	16	<1	3	4
Applicable *de minimis* level[5]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MBARD CEQA threshold	-	-	-	-	-	-	-	-	-	-	–[6]	–[6]	-	-	-	-	82	-	-	-
Alternative 2																				
2022	1	12	26	<1	<1	6	6	<1	1	2	8	121	244	1	1	65	66	1	15	15
2023	1	11	26	<1	<1	6	7	<1	2	2	7	107	225	1	1	60	61	1	14	14
2024	1	10	24	<1	<1	6	6	<1	1	1	6	81	201	1	1	49	49	1	12	12
2025	1	9	23	<1	<1	5	5	<1	1	1	5	96	185	1	1	47	47	1	11	12
2026	<1	6	16	<1	<1	3	3	<1	1	1	5	64	170	<1	<1	38	38	<1	9	9
2027	<1	11	11	<1	<1	4	4	<1	1	1	4	179	112	1	1	51	52	1	11	11
2028	<1	1	5	<1	<1	1	1	<1	<1	<1	5	132	158	1	1	49	50	1	10	11
Applicable *de minimis* level[5]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MBARD CEQA threshold	-	-	-	-	-	-	-	-	-	-	–[6]	–[6]	-	-	-	-	82	-	-	-
Alternative 3																				
2022	1	6	19	<1	<1	3	3	<1	1	1	5	63	181	1	<1	34	35	<1	7	8
2023	1	6	22	<1	<1	4	4	<1	1	1	5	63	177	1	<1	34	34	<1	7	8
2024	1	5	21	<1	<1	3	3	<1	1	1	5	46	169	<1	<1	27	27	<1	6	6
2025	<1	5	18	<1	<1	3	3	<1	1	1	4	59	161	1	<1	25	26	<1	6	6
2026	<1	3	12	<1	<1	2	2	<1	<1	<1	4	32	132	<1	<1	18	19	<1	4	4
2027	<1	4	6	<1	<1	2	2	<1	<1	<1	2	101	64	<1	1	23	23	<1	5	6
2028	<1	1	3	<1	<1	<1	<1	<1	<1	<1	3	66	92	<1	<1	21	21	<1	4	5
Applicable *de minimis* level[5]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MBARD CEQA threshold	-	-	-	-	-	-	-	-	-	-	–[6]	–[6]	-	-	-	-	82	-	-	-

Year[2]	Tons per year										Maximum Pounds per day[3]									
					PM_{10}			$PM_{2.5}$							PM_{10}			$PM_{2.5}$		
	VOC	NO_X	CO	SO_2	Exhaust	Dust	Total[4]	Exhaust	Dust	Total[4]	VOC	NO_X	CO	SO_2	Exhaust	Dust	Total[4]	Exhaust	Dust	Total[4]
Alternative 4																				
2022	1	12	23	<1	<1	7	7	<1	2	2	7	123	229	1	1	77	78	1	18	19
2023	1	12	25	<1	<1	8	8	<1	2	2	6	118	212	1	1	74	74	1	17	18
2024	1	11	23	<1	<1	8	8	<1	2	2	6	96	190	1	1	62	63	1	15	16
2025	1	11	21	<1	<1	7	7	<1	2	2	5	111	175	1	1	60	61	1	15	15
2026	<1	7	13	<1	<1	4	4	<1	1	1	4	84	153	<1	<1	54	55	<1	13	13
2027	<1	14	9	<1	<1	6	6	<1	1	1	5	200	150	1	1	66	67	1	13	14
2028	<1	1	4	<1	<1	1	1	<1	<1	<1	3	171	102	1	1	62	63	1	13	13
Applicable *de minimis* level[5]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MBARD CEQA threshold	-	-	-	-	-	-	-	-	-	-	-[6]	-[6]	-	-	-	-	82	-	-	-

[1] Emissions results include implementation of AQ-IAMF#1 and AQ-IAMF#2 through AQ-IAMF#5. Exceedances of MBARD CEQA thresholds are shown in **bolded underline with an asterisk (*)**.
[2] The analysis assumed that project construction would take place from 2022 to 2028. As construction is expected to take place later than these dates, the construction emissions estimates are conservative, as future emissions rates will be lower due to the implementation of cleaner and newer equipment.
[3] Presents the highest emissions estimate during a single day of construction in each year, based on concurrent construction activities.
[4] Total PM_{10} and $PM_{2.5}$ emissions consist of the exhaust and fugitive dust emissions. Annual values may not add due to rounding. Daily results may not add because the table presents maximum emissions results for each individual pollutant component. For example, the maximum PM exhaust emissions may not occur on the same day as the maximum total dust. emissions.
[5] The NCCAB is considered attainment for all criteria pollutants. As such, a general conformity analysis is not required, and there are no applicable *de minimis* thresholds.
[6] According to the MBARD CEQA guidelines, construction projects that temporarily emit precursors of O_3 (i.e., VOC or NO_X) are accommodated in the emission inventories of state- and federally required air plans and would not have a significant impact on the attainment and maintenance of state or federal O_3 ambient air quality standards (MBUAPCD 2008). The MBARD guidelines have an exception that if a project uses "non-typical equipment, e.g., grinders, and portable equipment," the project would use standard construction equipment.
- = no threshold
< = less than
CEQA = California Environmental Quality Act
CO = carbon monoxide
IAMF = impact avoidance and minimization feature
MBARD = Monterey Bay Air Resources District
MBUAPCD = Monterey Bay Unified Air Pollution Control District
NCCAB = North Central Coast Air Basin
NO_X = nitrogen oxide
O_3 = ozone
PM_{10} = particulate matter 10 microns or less in diameter
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compound

Impact AQ#3: Temporary Direct and Indirect Impacts on Air Quality within the SJVAB

Pollutants generated by construction activities within the SJVAB would be similar to those generated within the SFBAAB, as described under Impact AQ#1. The project will minimize impacts associated with fugitive dust emissions through implementation of a dust control plan (AQ-IAMF#1) and BMPs at new concrete batch plants (AQ-IAMF#6). The contractor will utilize low-VOC paints to limit the emissions of VOCs, which contribute to O_3 formation (AQ-IAMF#2). Exhaust-related pollutants will be minimized through use of renewable diesel, Tier 4 off-road engines, and model year 2010 or newer on-road engines, as required by AQ-IAMF#3 through AQ-IAMF#5.

Table 3.3-14 presents construction emissions from Alternatives 1 through 4 in the SJVAB in tons per year and pounds per day and includes AQ-IAMF#1 through AQ-IAMF#6. The table reflects the impact of the SAFE Vehicle Rule (CARB 2019a). Exceedances of federal *de minimis* and SJVAPCD CEQA thresholds are shown in bolded underline with an asterisk (*).

Even with incorporation of project features (IAMFs), all four project alternatives will result in a temporary impact on air quality during construction because increased NO_X, CO, and PM_{10} emissions will exceed the SJVAPCD's annual CEQA thresholds. NO_X emissions would also exceed the General Conformity *de minimis* threshold for all four alternatives. SJVAPCD's thresholds were established to prevent emissions from new projects in the SJVAB from contributing to CAAQS or NAAQS violations. Since construction emissions exceed these thresholds, the project would contribute a significant level of regional air pollution within the SJVAB. Moreover, project construction may also conflict with the *2016 Plan for the 2008 8-Hour Ozone Standard*, *2013 Plan for the Revoked 1-Hour Ozone Standard, 2007 Ozone Plan*, and the *PM_{10} Maintenance Plan and Request for Redesignation* (SJVAPCD 2016a, 2013, 2007a, 2007b). Certain individuals residing in areas that do not meet the CAAQS or NAAQS, including the SJVAB, could be exposed to pollutant concentrations that cause or aggravate acute and/or chronic health conditions (e.g., asthmas, lost work days, premature mortality). While construction of the project would contribute to existing and future air pollution, project-generated operational emissions represent approximately 0.05 percent, 0.02 percent, and 0.07 percent of SJVAB NOx, PM_{10}, and CO emissions (2015 and 2012 est.), respectively (SJVAPCD 2016b; CARB 2017). As previously discussed, the magnitude and locations of any potential changes in ambient air quality, and thus health consequences, from these additional emissions cannot be quantified with a high level of certainty due to the dynamic and complex nature of pollutant formation and distribution (e.g., meteorology, emissions sources, sunlight exposure). Similar limitations exist for precisely modeling project-level health consequences of directly emitted PM. However, it is known that public health would continue to be affected in SJVAB so long as the region does not attain the CAAQS or NAAQS.

This page intentionally left blank

Table 3.3-14 Construction-Related Criteria Pollutant Emissions in the San Joaquin Valley Air Basin[1]

	Tons per year										Average Pounds per day[3]									
					PM_{10}			$PM_{2.5}$							PM_{10}			$PM_{2.5}$		
Year[2]	VOC	NO_X	CO	SO_2	Exhaust	Dust	Total[4]	Exhaust	Dust	Total[4]	VOC	NO_X	CO	SO_2	Exhaust	Dust	Total[4]	Exhaust	Dust	Total[4]
Alternatives 1, 2, 3, and 4																				
2022	6	**42 ***	**218 ***	1	1	18	**18 ***	1	4	5	51	**348 ***	**1,789 ***	4	4	145	**149 ***	4	35	40
2023	6	**55 ***	**226 ***	1	1	23	**24 ***	1	5	6	51	**442 ***	**1,808 ***	4	5	184	**189 ***	5	41	45
2024	6	**56 ***	**220 ***	1	1	23	**23 ***	1	5	5	50	**450 ***	**1,763 ***	4	4	180	**185 ***	4	39	44
2025	6	**54 ***	**209 ***	1	1	20	**21 ***	1	4	5	47	**428 ***	**1,674 ***	4	4	160	**165 ***	4	35	39
2026	4	**45 ***	**131 ***	<1	<1	17	**17 ***	<1	4	4	30	**361 ***	**1,049 ***	3	3	135	**138 ***	3	28	32
2027	2	**50 ***	49	<1	<1	16	**17 ***	<1	3	3	14	**400 ***	**389 ***	1	3	129	**132 ***	3	25	28
2028	1	**10 ***	22	<1	<1	2	2	<1	1	1	8	**114 ***	**244 ***	<1	2	25	27	2	6	8
Applicable *de minimis* level[5]	10	10	-	70	-	-	70	-	-	100	-	-	-	-	-	-	-	-	-	-
SJVAPCD CEQA threshold	10	10	100	27	-	-	15	-	-	15	100[6]	100[6]	100[6]	100[6]	-	-	100[6]	-	-	100[6]

[1] Emissions results include implementation of AQ-IAMF#1 through AQ-IAMF#6. Exceedances of federal *de minims* and SJVAPCD CEQA thresholds are shown in **bolded underline with an asterisk (*)**.
[2] The analysis assumed that project construction would take place from 2022 to 2028. As construction is expected to take place later than these dates, the construction emissions estimates are conservative, as future emissions rates will be lower due to the implementation of cleaner and newer equipment.
[3] Presents the average emissions estimate during a single day of construction in each year. Average emissions are presented in SJVAPCD (rather than maximum emissions), consistent with (SJVAPCD 2015a) guidance for correct application of its 100-pound-per-day AAQA screening criteria.
[4] Total PM_{10} and $PM_{2.5}$ emissions consist of the exhaust and fugitive dust emissions. Annual values may not add due to rounding. Daily results may not add because the table presents maximum emissions results for each individual pollutant component. For example, the maximum PM exhaust emissions may not occur on the same day as the maximum total dust emissions.
[5] The General Conformity *de minimis* thresholds for criteria pollutants are based on the federal attainment status of the project vicinity in the SJVAB. The project vicinity is considered an extreme nonattainment area for the O_3 NAAQS, a serious/moderate nonattainment area for the $PM_{2.5}$ NAAQS, and a serious maintenance area for the PM_{10} NAAQS. Although the project vicinity is in attainment for SO_2, because SO_2 is a precursor for $PM_{2.5}$, the $PM_{2.5}$ General Conformity *de minimis* thresholds are used.
[6] The 100-pound-per-day threshold is a screening-level threshold to help determine whether increased emissions from a project will cause or contribute to a violation of CAAQS or NAAQS. Projects with emissions below the threshold would not be in violation of CAAQS or NAAQS. Projects with emissions above the threshold would require an AAQA to confirm this conclusion (SJVAPCD 2015a).
- = no threshold
< = less than
AAQA = ambient air quality analysis
CAAQS = California ambient air quality standards
CEQA = California Environmental Quality Act
CO = carbon monoxide
IAMF = impact avoidance and minimization feature
NAAQS = national ambient air quality standards
NO_X = nitrogen oxide
O_3 = ozone
PM_{10} = particulate matter 10 microns or less in diameter
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
SJVAB = San Joaquin Valley Air Basin
SJVAPCD = San Joaquin Valley Air Pollution Control District
SO_2 = sulfur dioxide
VOC = volatile organic compound

This page intentionally left blank

All project alternatives would result in the same amount of emissions because construction activities would be identical. Similar amounts of annual emissions would be generated during each year of construction between 2022 and 2027. Emissions would decline in 2028 after tunneling and other emissions-intensive activities are complete.

As shown in Table 3.3-15 through Table 3.3-18, construction emissions would also exceed the SJVAPCD's daily AAQA screening trigger for NO_X, CO, and PM_{10}. Localized air quality and public health impacts from these pollutants are evaluated based on the air dispersion modeling of ambient air concentrations. Impact AQ#5 discusses the conclusions of the modeled ambient air concentrations.

CEQA Conclusion

The impact would be significant under CEQA for all four project alternatives because construction could result in temporary exceedance of SJVAPCD's NO_X, CO, and PM_{10} annual thresholds. Project features (AQ-IAMF#1 through AQ-IAMF#6) will minimize air quality impacts through application of all best available on-site controls to reduce construction emissions. However, even with these features, exceedances of SJVAPCD's NO_X, CO, and PM_{10} annual thresholds will still occur and the project will contribute a significant level of regional NO_X, CO, and PM_{10} pollution within the SJVAB. Mitigation measures to address this impact are identified in Section 3.3.9, CEQA Significance Conclusions. Section 3.3.7, Mitigation Measures, describes these measures in detail.

Impact AQ#4: Temporary Direct Impacts on Implementation of an Applicable Air Quality Plan

Emissions from project construction would be temporary, occurring for approximately 7 years from 2022 through 2028. Once construction is complete, air quality in the SFBAAB, NCCAB, and SJVAB is expected to improve. However, during the construction period, construction activities could cause air quality impacts that exceed air district thresholds, which support implementation of air quality plans.

As described in Section 3.3.5.1, portions of the RSA in the SFBAAB and SJVAB are within nonattainment and maintenance areas for the NAAQS. Construction emissions generated within these nonattainment and maintenance areas are subject to USEPA's General Conformity thresholds. As discussed under Impacts AQ#1 and AQ#3, for all four project alternatives, NO_X emissions will exceed the General Conformity *de minimis* thresholds in the SFBAAB and SJVAB, even with implementation of all feasible on-site controls, as required by AQ-IAMF#1 through AQ-IAMF#6. Emissions of all other pollutants are below the applicable General Conformity thresholds.

The BAAQMD, MBARD, and SJVAPCD have also developed project-level thresholds. These thresholds prevent new projects from contributing to CAAQS or NAAQS violations, which supports implementation of regional air quality plans to attain federal and state ambient air quality standards. Construction emissions from all project alternatives (with or without the DDV and TDV) would exceed the BAAQMD's CEQA thresholds for VOC and NO_X, as well as SJVAPCD's CEQA thresholds[16] for NO_X and PM_{10}. Exceedances of adopted thresholds could conflict with applicable air quality plans. These exceedances will occur despite implementation of stringent on-site emissions controls, including implementation of fugitive dust control practices (AQ-IAMF#1 and AQ-IAMF#6), use of low-VOC paints (AQ-IAMF#2), use of renewable diesel (AQ-IAMF#3), use of Tier 4 off-road engines (AQ-IAMF#4), and use model year 2010 or newer on-road engines (AQ-IAMF#5).

CEQA Conclusion

The impact would be significant under CEQA because construction of the project alternatives could result in emissions that exceed air district thresholds. Exceedances of adopted thresholds could conflict with applicable air quality plans. These exceedances will occur despite stringent on-site

[16] Construction would also exceed SJVAPCD's CO threshold. However, the SJVAB is in attainment for the CO ambient air quality standards, and as such, there is no air quality attainment plan. Specific regional and local impacts from construction-generated CO emissions are assessed in Impacts AQ-3 and AQ-5, respectively.

emissions controls (project features) that the Authority will require to reduce construction emissions. Mitigation measures to address this impact are identified in Section 3.3.9, CEQA Significance Conclusions. Section 3.3.7, Mitigation Measures, describes these measures in detail.

Impact AQ#5: Temporary Direct Impacts on Localized Air Quality—Criteria Pollutants[17]

Project construction has the potential to cause elevated criteria pollutant concentrations. These elevated concentrations may cause or contribute to exceedances of the short- and long-term NAAQS and CAAQS and affect local air quality and public health. The criteria pollutants of concern with established annual standards are NO_2, PM_{10}, and $PM_{2.5}$. The criteria pollutants of concern with established hourly or daily standards are the following:

- CO (1 hour and 8 hours)
- PM_{10} and $PM_{2.5}$ (24 hours)
- NO_2 (1 hour)
- SO_2 (1 hour and 24 hours)

Table 3.3-15 and Table 3.3-16 present the estimated maximum hourly and daily concentrations relative to the CAAQS and NAAQS, respectively. The tables present both the incremental project and total pollutant concentration; only the total pollutant concentration, which reflects the incremental project contribution plus the existing concentration, is compared to the CAAQS and NAAQS to determine if construction would cause an ambient air quality violation.

Table 3.3-17 presents the estimated maximum annual concentrations relative to the CAAQS and NAAQS. Similar to the hourly and daily analysis, only the total pollutant concentration (project plus background) is compared to the CAAQS and NAAQS.

As discussed in Section 3.3.4.5, Method for Determining Significance under CEQA, background concentrations of PM_{10} along the project corridor exceed the CAAQS. Similarly, background $PM_{2.5}$ concentrations exceed the daily NAAQS and annual CAAQS and NAAQS in the SJVAB. Consequently, Table 3.3-18 compares the incremental project increase in PM concentrations to the applicable SIL, as recommended by the SJVAPCD (2015a) and BAAQMD (Kirk 2016), to analyze the potential for the project to worsen existing $PM_{2.5}$ and PM_{10} violations.

The modeled concentrations presented in Table 3.3-15 through Table 3.3-18 include project features AQ-IAMF#1 through AQ-IAMF#6. Criteria pollutant concentrations are estimated for each subsection based on representative local meteorological conditions. Only the modeled maximum pollutant concentration is reported; refer to the Air Quality and Greenhouse Gases Technical Report (Volume 2, Appendix 3.3-A) for detailed concentration results by individual construction activity (e.g., at grade, tunnel). Exceedances of CAAQS are shown in bolded underline with an asterisk (*).

As shown in Table 3.3-15 through Table 3.3-18, project construction would lead to localized violations of the PM_{10}, $PM_{2.5}$, and NO_2 CAAQS and NAAQS, as well as exceedances of the PM_{10} and $PM_{2.5}$ SIL, indicating that construction-generated PM could contribute to existing PM_{10} and $PM_{2.5}$ violations of the ambient air quality standards. The CAAQS and NAAQS define clean air and represent the maximum amount of pollution that can be present in outdoor air without any harmful effects on people and the environment. Short-term exposure to NO_2 concentrations above the CAAQS or NAAQS can aggravate respiratory diseases (e.g., asthma) or lead to other respiratory symptoms (e.g., coughing, wheezing) in certain individuals. The main health effects of airborne PM are on the respiratory and cardiovascular system. Certain individuals exposed to PM concentrations above the CAAQS or NAAQS may experience irritation of the airways, decreased lung function, irregular heartbeat, nonfatal heart attacks, and premature death.

[17] Refinements were made to the particulate matter mass emissions inventory to more comprehensively capture emissions reductions that would be achieved through implementation of AQ-IAMF#1: Fugitive Dust Emissions. These revisions were made for the final air quality analysis, as reported in Tables 3.3-12 through 3.3-14. Concentration modeling for localized particulate matter was performed prior to the refinement. Accordingly, the particulate matter results shown in Tables 3.3-15 through 3.3-18 in this impact are conservative.

Table 3.3-15 Maximum Hourly and Daily CAAQS Criteria Pollutant Concentration Impacts from Project Construction (µg/m³)[1]

Alternative and Subsection	CO				NO_2		SO_2			
	1-hour		8-hour		1-hour		1-hour		24-hour	
	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]
Alternative 1										
San Jose Diridon Station Approach	267	3,016	147	2,209	119	246	1	11	<1	3
Monterey Corridor	80	2,829	45	2,107	56	184	<1	10	<1	3
Morgan Hill and Gilroy	605	5,417	149	2,211	234	**362 ***	2	12	<1	3
Pacheco Pass	525	5,337	85	1,116	180	242	1	10	<1	3
San Joaquin Valley	902	7,546	190	3,741	170	243	1	30	<1	6
Alternative 2										
San Jose Diridon Station Approach	317	3,066	147	2,209	119	247	1	11	<1	3
Monterey Corridor	582	3,331	218	2,280	233	**361 ***	2	11	<1	3
Morgan Hill and Gilroy	611	5,423	152	2,215	201	329	1	11	<1	3
Pacheco Pass	525	5,337	85	1,116	180	242	1	10	<1	3
San Joaquin Valley	902	7,546	190	3,741	170	243	1	30	<1	6
Alternative 3										
San Jose Diridon Station Approach	317	3,066	147	2,209	119	247	1	11	<1	3
Monterey Corridor	80	2,829	45	2,107	56	184	<1	10	<1	3
Morgan Hill and Gilroy	606	5,418	148	2,210	101	229	1	11	<1	3
Pacheco Pass	525	5,337	85	1,116	180	242	1	10	<1	3
San Joaquin Valley	902	7,546	190	3,741	170	243	1	30	<1	6

Alternative and Subsection	CO				NO_2		SO_2			
	1-hour		8-hour		1-hour		1-hour		24-hour	
	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]
Alternative 4										
San Jose Diridon Station Approach	218	2,967	111	2,173	81	209	1	10	<1	3
Monterey Corridor	122	2,871	68	2,130	74	202	<1	10	<1	3
Morgan Hill and Gilroy	1,282	6,094	270	2,332	274	**401 ***	2	12	<1	3
Pacheco Pass	525	5,337	85	1,116	180	242	1	10	<1	3
San Joaquin Valley	902	7,546	190	3,741	170	243	1	30	<1	6
CAAQS	-	23,000	-	10,000	-	339	-	655	-	105

[1] Only the highest modeled concentration is presented for each pollutant. Concentration results include implementation of AQ-IAMF#1 through AQ-IAMF#6. Exceedances of CAAQS are shown in **bolded underline with an asterisk (*)**. Note that background PM_{10} concentrations exceed the CAAQS in all project subsections. Consequently, the potential for the project to contribute to the existing violations is analyzed in Table 3.3-17.
[2] Represents the maximum incremental off-site concentration from project construction.
[3] Represents the maximum project-level incremental contribution plus background concentration.
- = no standard
< = less than
$\mu g/m^3$ = micrograms per cubic meter of air
CAAQS = California ambient air quality standards
CO = carbon monoxide
IAMF = impact avoidance and minimization feature
NO_2 = nitrogen dioxide
PM_{10} = particulate matter 10 microns or less in diameter
SO_2 = sulfur dioxide

Table 3.3-16 Maximum Hourly and Daily NAAQS Criteria Pollutant Concentration Impacts from Project Construction (µg/m³)[1]

Alternative and Subsection	CO				NO_2		$PM_{2.5}$		PM_{10}		SO_2	
	1-hour		8-hour		1-hour		24-hour		24-hour		1-hour	
	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]
Alternative 1												
San Jose Diridon Station Approach	286	2,617	134	1,891	81	167	13	**44 ***	72	122	1	7
Monterey Corridor	79	2,408	38	1,794	44	129	2	33	20	70	<1	6
Morgan Hill and Gilroy	439	2,769	135	1,892	138	**223 ***	10	**41 ***	47	103	1	7
Pacheco Pass	421	2,636	79	1,072	96	145	2	**40 ***	11	78	<1	6
San Joaquin Valley	803	4,278	182	1,404	81	143	-[4]		40	113	1	16
Alternative 2												
San Jose Diridon Station Approach	286	2,626	135	1,892	79	164	13	**44 ***	72	122	1	7
Monterey Corridor	527	2,857	201	1,958	129	**214 ***	17	**48 ***	93	142	1	7
Morgan Hill and Gilroy	456	2,785	135	1,891	111	**196 ***	11	**42 ***	54	110	1	7
Pacheco Pass	421	2,636	79	1,072	96	145	2	**40 ***	11	78	<1	6
San Joaquin Valley	803	4,278	182	1,404	81	143	-[4]		40	113	1	16
Alternative 3												
San Jose Diridon Station Approach	286	2,626	135	1,892	79	164	13	**44 ***	72	122	1	7
Monterey Corridor	79	2,408	38	1,794	44	129	2	33	20	70	<1	6
Morgan Hill and Gilroy	445	2,685	135	1,892	47	132	3	34	19	75	1	7
Pacheco Pass	421	2,636	79	1,072	96	145	2	**40 ***	11	78	<1	6
San Joaquin Valley	803	4,278	182	1,404	81	143	-[4]		40	113	1	16

Alternative and Subsection	CO				NO_2		$PM_{2.5}$		PM_{10}		SO_2	
	1-hour		8-hour		1-hour		24-hour		24-hour		1-hour	
	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]
Alternative 4												
San Jose Diridon Station Approach	181	2,511	83	1,840	57	143	20	**51 ***	47	97	<1	7
Monterey Corridor	120	2,450	58	1,814	60	145	4	35	28	77	<1	6
Morgan Hill and Gilroy	897	3,227	240	1,996	152	**238 ***	22	**53 ***	130	**187 ***	1	8
Pacheco Pass	421	2,636	79	1,072	96	145	2	**40 ***	11	78	<1	6
San Joaquin Valley	803	4,278	182	1,404	81	143	-[4]		40	113	1	16
NAAQS	-	40,000	-	10,000	-	188	-	35	-	150	-	196

[1] Only the highest modeled concentration is presented for each pollutant. Concentration results include implementation of AQ-IAMF#1 through AQ-IAMF#6. Exceedances of NAAQS are shown in **bolded underline with an asterisk (*)**.
[2] Represents the maximum incremental off-site concentration from project construction.
[3] Represents the maximum project-level incremental contribution plus background concentration.
[4] Background concentrations in the SJVAB exceed the NAAQS. Consequently, the potential for the project to contribute to the existing violation is analyzed in Table 3.3-18.
- = no standard
< = less than
$\mu g/m^3$ = micrograms per cubic meter of air
CO = carbon monoxide
IAMF = impact avoidance and minimization feature
NAAQS = national ambient air quality standards
NO_2 = nitrogen dioxide
PM_{10} = particulate matter 10 microns or less in diameter
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
SJVAB = San Joaquin Valley Air Basin
SO_2 = sulfur dioxide

Table 3.3-17 Maximum Annual CAAQS and NAAQS Criteria Pollutant Concentration Impacts from Project Construction (µg/m³)[1]

Construction Area	NO_2 (CAAQS)		NO_2 (NAAQS)		$PM_{2.5}$ (CAAQS)		$PM_{2.5}$ (NAAQS)		PM_{10} (CAAQS)	
	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]
Alternative 1										
San Jose Diridon Station Approach	6	30	5	30	1	12	1	10	-[4]	
Monterey Corridor	6	30	5	28	1	11	1	10	-[4]	
Morgan Hill and Gilroy	5	35	4	34	1	12	1	10	5	**25 ***
Pacheco Pass	11	20	10	19	1	**13 ***	1	**13 ***	-[4]	
San Joaquin Valley	1	14	1	14	-[4]		-[4]		-[4]	
Alternative 2										
San Jose Diridon Station Approach	6	30	5	28	1	11	1	11	-[4]	
Monterey Corridor	13	37	12	34	2	**12 ***	2	11	-[4]	
Morgan Hill and Gilroy	8	32	7	30	1	12	1	11	7	**27 ***
Pacheco Pass	11	20	10	19	1	**13 ***	1	**13 ***	-[4]	
San Joaquin Valley	1	14	1	14	-[4]		-[4]		-[4]	
Alternative 3										
San Jose Diridon Station Approach	6	30	5	28	1	11	1	11	-[4]	
Monterey Corridor	6	30	5	28	1	11	1	10	-[4]	
Morgan Hill and Gilroy	3	27	3	25	<1	11	<1	11	2	**22 ***
Pacheco Pass	11	20	10	19	1	**13 ***	1	**13 ***	-[4]	
San Joaquin Valley	1	14	1	14	-[4]		-[4]		-[4]	

Construction Area	NO_2 (CAAQS)		NO_2 (NAAQS)		$PM_{2.5}$ (CAAQS)		$PM_{2.5}$ (NAAQS)		PM_{10} (CAAQS)	
	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]	Project[2]	Total[3]
Alternative 4										
San Jose Diridon Station Approach	7	31	6	29	2	**12 ***	2	11	-[4]	
Monterey Corridor	6	30	6	29	1	12	1	10	-[4]	
Morgan Hill and Gilroy	3	27	3	26	1	11	1	10	3	**23 ***
Pacheco Pass	11	20	10	19	1	**13 ***	1	**13 ***	-[4]	
San Joaquin Valley	1	14	1	14	-[4]		-[4]		-[4]	
CAAQS/NAAQS	-	57	-	100	-	12	-	12	-	20

[1] Only the highest modeled concentration is presented for each pollutant. Concentration results include implementation of AQ-IAMF#1 through AQ-IAMF#6. Exceedances of CAAQS/NAAQS are shown in **bolded underline and an asterisk (*)**.
[2] Represents the maximum incremental off-site concentration from project construction.
[3] Represents the maximum project-level incremental contribution plus background concentration.
[4] Background concentrations exceed the NAAQS or CAAQS. Consequently, the potential for the project to contribute to the existing violation is analyzed in Table 3.3-18.
- = no standard
< = less than
$\mu g/m^3$ = micrograms per cubic meter of air
CAAQS = California ambient air quality standards
NAAQS = national ambient air quality standards
NO_2 = nitrogen dioxide
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
PM_{10} = particulate matter 10 microns or less in diameter

Table 3.3-18 Maximum Incremental PM_{10} and $PM_{2.5}$ Concentrations from Project Construction (µg/m³)[1]

Construction Area	$PM_{2.5}$ (NAAQS) 24-hour[2]	PM_{10} (CAAQS) 24-hour[2]	PM_{10} (CAAQS) Annual[2]	$PM_{2.5}$ (CAAQS/NAAQS) Annual[2]
Alternative 1				
San Jose Diridon Station Approach	–[3]	**80.4 ***	**5.50 ***	**0.9 ***
Monterey Corridor		**20.5 ***	**5.70 ***	**0.9 ***
Morgan Hill and Gilroy		**50.9 ***	–[3]	**1.0 ***
Pacheco Pass		**10.9 ***	**2.40 ***	**0.9 ***
San Joaquin Valley	**5.8 ***	**49.3 ***	0.55	0.1
Alternative 2				
San Jose Diridon Station Approach	–[3]	**80.4 ***	**5.50 ***	**0.9 ***
Monterey Corridor		**122.2 ***	**10.30 ***	**0.8 ***
Morgan Hill and Gilroy		**64.1 ***	–[3]	**1.0 ***
Pacheco Pass		**10.9 ***	**2.40 ***	**0.9 ***
San Joaquin Valley	**5.8 ***	**49.3 ***	0.55	0.1
Alternative 3				
San Jose Diridon Station Approach	–[3]	**80.4 ***	**5.50 ***	**0.9 ***
Monterey Corridor		**20.5 ***	**5.70 ***	**0.9 ***
Morgan Hill and Gilroy		**21.7 ***	–[3]	**0.3 ***
Pacheco Pass		**10.9 ***	**2.40 ***	**0.9 ***
San Joaquin Valley	**5.8 ***	**49.3 ***	0.55	0.1

Construction Area	$PM_{2.5}$ (NAAQS) 24-hour[2]	PM_{10} (CAAQS) 24-hour[2]	PM_{10} (CAAQS) Annual[2]	$PM_{2.5}$ (CAAQS/NAAQS) Annual[2]
Alternative 4				
San Jose Diridon Station Approach	–[3]	**53.7 ***	**7.00 ***	**1.7 ***
Monterey Corridor		**29.1 ***	**5.50 ***	**1.0 ***
Morgan Hill and Gilroy		**138.0 ***	–[3]	**0.6 ***
Pacheco Pass		**10.9 ***	**2.40 ***	**0.9 ***
San Joaquin Valley	**5.8 ***	**49.3 ***	0.55	0.1
SIL	1.2	10.4	2.08	0.2

[1] Only the highest modeled concentration is presented for each pollutant. Concentration results include implementation of AQ-IAMF#1 through AQ-IAMF#6. Exceedances of the SIL are shown in **bolded underline and an asterisk (*)**.
[2] Represents the maximum incremental off-site concentration from project construction.
[3] Background concentrations do not exceed the NAAQS or CAAQS. Consequently, the potential for the project to create new violations is analyzed in Table 3.3-14 through Table 3.3-16.
$\mu g/m^3$ = micrograms per cubic meter of air
CAAQS = = California ambient air quality standards
IAMF = impact avoidance and minimization feature
NAAQS = national ambient air quality standards
PM_{10} = particulate matter 10 microns or less in diameter
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
SIL = significant impact level

The amount of construction effort for the design variants would be approximately the same as the alternatives without the DDV and TDV and thus the amount of construction period criteria pollutant emissions would be approximately the same. Within the San Jose Diridon Station Approach Subsection, all project alternatives would violate the 24-hour $PM_{2.5}$ NAAQS, annual $PM_{2.5}$ SIL, and 24-hour and annual PM_{10} SILs. Berm and embankment construction under all alternatives would be the primary emissions-generating activity contributing to the violations. The extensive amount of berm construction under Alternative 4 in the San Jose Diridon Station Approach Subsection is also predicted to result in a violation of the annual $PM_{2.5}$ CAAQS.

Within the Monterey Corridor Subsection, all project alternatives would exceed the 24-hour PM_{10} SIL, annual PM_{10} SIL, and annual $PM_{2.5}$ SIL. Alternative 2 would also violate the 1-hour NO_2 CAAQS and NAAQS, annual $PM_{2.5}$ CAAQS, and 24-hour $PM_{2.5}$ NAAQS, primarily due to trenching activities. The primary types of construction contributing to these violations are at grade (Alternative 1) and aerial (Alternative 4).

Ambient air quality violations within the Morgan Hill and Gilroy Subsection would be similar to those in the Monterey Corridor Subsection, with all project alternatives exceeding the 24-hour and annual PM_{10} SIL, annual PM_{10} CAAQS, and annual $PM_{2.5}$ SIL. Alternative 4 would likewise violate the 1-hour NO_2 CAAQS and NAAQS, 24-hour $PM_{2.5}$ NAAQS, and 24-hour PM_{10} NAAQS, primarily due to aerial construction. Alternatives 1 and 2 would also violate the 1-hour NO_2 NAAQS and 24-hour $PM_{2.5}$ NAAQS. Concurrent construction of multiple project components would also lead to 1-hour NO_2 CAAQS violations under Alternative 1.

Ambient air quality violations within the Pacheco Pass Subsection are driven by batching and tunneling activities, which would be similar across all alternatives. Accordingly, construction of all four project alternatives is predicted to violate the 24-hour $PM_{2.5}$ NAAQS and annual $PM_{2.5}$ CAAQS and NAAQS. All alternatives would also exceed the 24-hour and annual PM_{10} SIL and annual $PM_{2.5}$ SIL.

Construction activities within the San Joaquin Valley Subsection would be identical among the four project alternatives. Emissions concentrations from berm construction and construction of the MOWS would violate the 24-hour $PM_{2.5}$ and PM_{10} SILs. These exceedances would occur under all alternatives.

CEQA Conclusion

The impact would be significant under CEQA for all four project alternatives because construction could result in temporary violations of the CAAQS and NAAQS and contribute to existing violations of the $PM_{2.5}$ and PM_{10} standards. Project features (AQ-IAMF#1 through AQ-IAMF#6) will minimize construction emissions through implementation of the best available on-site controls. However, exceedances of the CAAQS and NAAQS would still occur and the project would contribute a significant level of localized NO_2 and PM pollution within the RSA. Mitigation measures to address this impact are identified in Section 3.3.9, CEQA Significance Conclusions. Section 3.3.7, Mitigation Measures, describes these measures in detail.

Impact AQ#6: Temporary Direct Impacts on Localized Air Quality—Exposure to Diesel Particulate Matter and $PM_{2.5}$ (Health Risk)

Project construction, including project features AQ-IAMF#1 through AQ-IAMF#6, has the potential to create inhalation health risks and exposure to $PM_{2.5}$ at receptor locations adjacent to the project footprint. Cancer risk from exposure to diesel exhaust is much higher than the risk associated with any other air toxic from construction of the project alternatives. Construction would result in DPM emissions primarily from diesel-fueled off-road equipment and heavy-duty trucks.

Table 3.3-19 through Table 3.3-21 show estimated construction-related health risks relative to the BAAQMD, MBARD, and SJVAPCD thresholds, respectively, for all four project alternatives. Local topography and meteorology can greatly influence DPM air concentrations and the resulting exposure and health risk. Consequently, analysts estimated health risks for each of the five project subsections based on representative local meteorological conditions. The health risks shown in Table 3.3-19 through Table 3.3-21 represent the highest modeled off-site risk, which typically occurs adjacent to or within a few hundred yards of the construction footprint.

Table 3.3-19 Excess Cancer, Noncancer, and $PM_{2.5}$ Concentration Health Risks Associated with Construction of Alternatives 1, 2, 3, and 4 in the Bay Area Air Quality Management District[1]

Alternative/Subsection	Cancer (per million)[2]	Chronic HI[3]	Acute HI[3]	$PM_{2.5}$ (µg/m³)
Alternative 1				
San Jose Diridon Station Approach	3.8	<0.1	0.2	<0.1
Monterey Corridor	4.8	<0.1	0.1	<0.1
Morgan Hill and Gilroy	2.7	<0.1	0.4	<0.1
Pacheco Pass	0.6	<0.1	0.4	<0.1
Alternative 2				
San Jose Diridon Station Approach	3.9	<0.1	0.2	<0.1
Monterey Corridor	5.0	<0.1	0.1	<0.1
Morgan Hill and Gilroy	4.6	<0.1	0.3	<0.1
Pacheco Pass	0.6	<0.1	0.4	<0.1
Alternative 3				
San Jose Diridon Station Approach	3.9	<0.1	0.2	<0.1
Monterey Corridor	2.7	<0.1	0.4	<0.1
Morgan Hill and Gilroy	9.4	<0.1	0.1	<0.1
Pacheco Pass	0.6	<0.1	0.4	<0.1
Alternative 4				
San Jose Diridon Station Approach	5.5	<0.1	0.1	<0.1
Monterey Corridor	6.1	<0.1	0.2	<0.1
Morgan Hill and Gilroy	2.6	<0.1	0.4	<0.1
Pacheco Pass	0.6	<0.1	0.4	<0.1
Threshold	**10.0**	**1.0**	**1.0**	**0.3**

[1] Only the highest modeled off-site risk is presented for each subsection. The reported risk includes impacts from combined construction of all features (e.g., at grade, viaduct, concrete batch plants) in each subsection. Refer to Appendix E of the Air Quality and Greenhouse Gases Technical Report (Volume 2, Appendix 3.3-A) for individual risk contributions.
[2] Cancer risk represents the incremental increase in the number of cancers in a population of one million. Risks are cumulative of inhalation, dermal, soil, mother's milk, and crop pathways.
[3] HI is shown by pollutant contributions to the most affected organ system (respiratory). All NO_2 risks assume an 80 percent ambient ratio to NO_X concentrations.

< = less than
µg/m³ = micrograms per cubic meter of air
HI = hazard index
NO_2 = nitrogen dioxide
NO_X = nitrogen oxides
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter

Table 3.3-20 Excess Cancer and Noncancer Health Risks Associated with Construction of Alternatives 1, 2, 3, and 4 in the Monterey Bay Air Resources District[1]

Alternative/Subsection	Cancer (per million)[2]	Chronic HI[3]	Acute HI[3]
Alternative 1			
Morgan Hill and Gilroy	2.7	<0.1	0.4
Alternative 2			
Morgan Hill and Gilroy	4.6	<0.1	0.3
Alternative 3			
Morgan Hill and Gilroy	9.4	<0.1	0.1
Alternative 4			
Morgan Hill and Gilroy	2.6	<0.1	0.4
Threshold	**10.0**	**1.0**	**1.0**

[1] Only the highest modeled off-site risk is presented for each subsection. The reported risk includes impacts from combined construction of all features (e.g., at grade, viaduct, concrete batch plants) in each subsection. Refer to Appendix E of the Air Quality and Greenhouse Gases Technical Report (Volume 2, Appendix 3.3-A) for individual risk contributions.
[2] Cancer risk represents the incremental increase in the number of cancers in a population of one million. Risks are cumulative of inhalation, dermal, soil, mother's milk, and crop pathways.
[3] HI is shown by pollutant contributions to the most affected organ system (respiratory). All NO_2 risks assume an 80 percent ambient ratio to NO_X concentrations.
< = less than
HI = hazard index
NO_2 = nitrogen dioxide
NO_X = nitrogen oxides

Table 3.3-21 Excess Cancer and Noncancer Health Risks Associated with Construction of Alternatives 1, 2, 3, and 4 in the San Joaquin Valley Air Pollution Control District[1]

Alternative/Subsection	Cancer (per million)[2]	Chronic HI[3]	Acute HI[3]
Alternative 1			
Pacheco Pass	0.6	<0.1	0.4
San Joaquin Valley	5.0	<0.1	0.1
Alternative 2			
Pacheco Pass	0.6	<0.1	0.4
San Joaquin Valley	5.0	<0.1	0.1
Alternative 3			
Pacheco Pass	0.6	<0.1	0.4
San Joaquin Valley	5.0	<0.1	0.1
Alternative 4			
Pacheco Pass	0.6	<0.1	0.4
San Joaquin Valley	5.0	<0.1	0.1
Threshold	**20.0**	**1.0**	**1.0**

[1] Only the highest modeled off-site risk is presented for each subsection. The reported risk includes impacts from combined construction of all features (e.g., at grade, viaduct) in each subsection. Refer to Appendix E of the Air Quality and Greenhouse Gases Technical Report (Volume 2, Appendix 3.3-A) for individual risk contributions.
[2] Cancer risk represents the incremental increase in the number of cancers in a population of one million. Risks are cumulative of inhalation, dermal, soil, mother's milk, and crop pathways.
[3] HI is shown by pollutant contributions to the most affected organ system (respiratory). All NO_2 risks assume an 80 percent ambient ratio to NO_X concentrations.
< = less than
HI = hazard index
NO_2 = nitrogen dioxide
NO_X = nitrogen oxides

The health risk results among the alternatives are influenced by the anticipated intensity and duration of construction activity, as well as proximity to receptors. As shown in Table 3.3-19, health risks within San Jose Diridon Station Approach and Monterey Corridor Subsections in the BAAQMD would be similar among all alternatives, with Alternative 4 resulting in the greatest potential risk. The amount of construction effort for the design variants would be approximately the same as the alternatives without the DDV and TDV and thus the amount of construction period TAC emissions would be approximately the same. Under Alternative 4 with the DDV, the DDV would be constructed closer to a few sensitive receptors east of the construction area north of the SAP Center. However, these receptors are farther from the construction footprint than the maximally affected receptor under Alternative 4 without the DDV. Table 3.3-19 presents the results for this maximally affected receptor and demonstrates that risks would be below BAAQMD thresholds. Because the nearest affected receptors to the DDV construction would be located further away from construction than the most affected receptors along the rest of Alternative 4 without the DDV, the nearest receptors during DDV construction would not be exposed to health risks or $PM_{2.5}$ concentrations above the BAAQMD thresholds. The TDV is in the same location as the alternatives without the TDV and thus would not change construction effects on any receptors. Alternative 4 would require the highest levels of earthwork construction for berm and at-grade track within these subsections. The higher levels of earthwork construction would require additional equipment that generates higher levels of DPM, which present slightly greater health risks under Alternative 4. Within the Morgan Hill and Gilroy Subsection, Alternative 3 is predicted to add the greatest excess cancer risk because several residential receptors are near this alignment where it passes through “Old Gilroy” (SR 152 and Frazier Lake Road). Health risks within the Pacheco Pass Subsection in the BAAQMD would be the same among all alternatives.

As shown in Table 3.3-20, health risks within the MBARD would be similar to those quantified in the BAAQMD for the Morgan Hill and Gilroy Subsection. Alternative 3 is predicted to add the greatest excess cancer risk because the alignment passes near residents along Lover’s Lane. Risks within the SJVAPCD would be the same among all alternatives (see Table 3.3-21) because construction activities would be identical. Risks would be greatest in the San Joaquin Valley Subsection, where berm construction would require concrete work for starter panels and walls, placing of the fill material, placing of the panels and straps, and railbed construction. These activities would require a good amount of diesel-powered construction equipment.

While the intensity of health risks would vary by location, none of project alternatives would result in increased cancer or health hazards, or $PM_{2.5}$ concentrations in excess of BAAQMD, MBARD, or SJVAPCD thresholds.

CEQA Conclusion

The impact would be less than significant under CEQA because the incremental increases in maximum cancer risk and noncancer health hazards would not exceed air district thresholds. Therefore, CEQA does not require mitigation.

Impact AQ#7: Temporary Direct Impacts on Localized Air Quality—Exposure to Asbestos, Lead-Based Paint, and Fungal Spores That Cause Valley Fever

NOA could become airborne as a result of excavating (including cuts and drilling deep foundations for aerial structures) or tunneling through ultramafic and metavolcanic bedrock. Based on information presented in the *San Jose to Merced Project Section Geology, Soils, and Seismicity Technical Report* (Authority 2019b), no ultramafic or metavolcanic bedrock is mapped in the San Jose Diridon Station Approach or San Joaquin Valley Subsections. However, more than half of the alignment in the Pacheco Pass Subsection would involve tunneling through bedrock that may contain zones of ultramafic or metavolcanic bedrock. Similarly, ultramafic rock is present within the Monterey Corridor and Morgan Hill and Gilroy Subsections. While excavation and soil movement in these subsections may disturb NOA, the design-build contractor will prepare a construction management plan that outlines practices for avoiding and minimizing airborne release of NOA (GEO-IAMF#5). Construction contractors would also be required to comply with the BAAQMD’s Asbestos Airborne Toxic Control Measure for Construction and

Grading Operations, which requires implementation of dust control measures to limit the potential for airborne asbestos.

The demolition of asbestos-containing materials is subject to the limitations of the National Emissions Standards for Hazardous Air Pollutants (40 C.F.R. Parts 61 and 63) regulations and would require an asbestos inspection. The BAAQMD, MBARD, and SJVAPCD would be consulted before demolition begins. The project would include strict compliance with existing asbestos regulations as part of project design.

Buildings in the air quality RSA might be contaminated with residual Pb, which was used as a pigment and drying agent in oil-based paint until the Lead-Based Paint Poisoning Prevention Act of 1971 prohibited such use. If encountered during structure demolitions and relocations, LBP and asbestos would be handled and disposed of in accordance with applicable standards.

The Authority will require construction contractors to prepare demolition plans with specific provisions for asbestos and LBP abatement for structures slated for demolition or renovation (HMW-IAMF#5). This will minimize the potential exposure of the public and construction workers to these hazardous materials. Implementation of a hazardous materials and waste plan, including procedures for hazardous waste transport, containment, and storage (HMW-IAMF#10), will further minimize potential health impacts on workers and community members during project demolition activities (Section 3.10, Hazardous Materials and Waste).

Alternative 2 requires the most demolition (7.1 million square feet), and therefore has the highest potential to encounter and expose receptors to impacts from asbestos and LBP. Alternative 1 requires the second most demolition (4.3 million square feet), followed by Alternative 3 (4.0 million square feet) and Alternative 4 (2.0 million square feet). The amount of construction effort for the design variants would be approximately the same as the alternatives without the DDV and TDV and thus the amount of demolition would be approximately the same. Under Alternative 4 with the DDV, the DDV would be constructed closer to a few sensitive receptors east of the construction area north of the SAP Center. However, these receptors are farther from the construction footprint than the maximally affected receptor under Alternative 4 without the DDV. Because the nearest affected receptors to the DDV construction would be located farther away from construction than the most affected receptors along the rest of the Alternative 4 without the DDV, potential exposure to asbestos and LBP under Alternative 4 with the DDV is likely to be less than under Alternative 4. The TDV is in the same location as the alternatives without the TDV and thus would not change construction effects on any receptors. The project alternatives would all follow the same construction techniques and comply with the same regulations and standards to minimize exposure to these substances. Refer to the Air Quality and Greenhouse Gases Technical Report (Appendix 3.3-A) for additional information on demolition activities and quantities.

While there are several factors that influence receptor exposure and development of Valley fever, earthmoving activities during construction could release *C. immitis* spores if the spores are present in the soil. Receptors adjacent to the construction area may therefore be exposed to increased risk of inhaling *C. immitis* spores and subsequent development of Valley fever. Dust-control measures are the primary defense against infection (USGS 2000). The project includes all best available fugitive dust control measures (see AQ-IAMF#1), which will avoid dusty conditions and reduce the risk of contracting Valley fever through routine watering and other measures.

Alternative 2 would require the most earthmoving (60.4 million cubic yards and 1,047 acres disturbed), and therefore has the highest potential to encounter and expose receptors to impacts from Valley fever. Alternative 4 requires the second most earthmoving (52.2 million cubic yards and 1,048 acres disturbed), followed by Alternative 3 (58.7 million cubic yards and 870 acres disturbed) and Alternative 1 (51.5 million cubic yards and 813 acres disturbed). The project alternatives would all follow the same construction techniques and comply with the same regulations and standards to minimize exposure to these substances. Refer to the Air Quality and Greenhouse Gases Technical Report (Appendix 3.3-A) for additional information on earthmoving activities and quantities.

CEQA Conclusion

The impact would be less than significant under CEQA because the project design and compliance with existing asbestos and LBP handling and disposal standards would prevent exposure of sensitive receptors to substantial pollutant concentrations with respect to asbestos and LBP. The project includes all best available fugitive dust control measures (AQ-IAMF#1) that will avoid dusty conditions and reduce the risk of contracting Valley fever through routine watering and other measures. Accordingly, the project would not expose receptors to substantial public health risks related to asbestos, LBP, or Valley fever. Therefore, CEQA does not require mitigation.

Impact AQ#8: Temporary Direct Impacts on Localized Air Quality—Exposure to Odors

Sources of odor during construction would include diesel exhaust from construction equipment and asphalt paving. All odors would be localized and generally confined to the immediate area surrounding the construction site. The project would use standard construction techniques, and the equipment odors would be typical of most construction sites. These odors would be temporary and localized, and they would cease once construction activities have been completed. The BAAQMD, MBARD, and SJVAPCD have adopted rules that limit the amount of VOC emissions from cutback asphalt, which would also reduce construction-related odors. The potential for impacts would be the same for all four project alternatives (with and without the DDV and TDV) because all project alternatives would follow the same construction techniques and comply with the same air district rules to limit odors.

CEQA Conclusion

The impact would be less than significant under CEQA because odors generated during construction would not be expected to affect a substantial number of people or result in nuisance complaints. Therefore, CEQA does not require mitigation.

Operations Impacts

Project operations would include HSR maintenance activities and operation of stations and maintenance facilities. Operations and maintenance activities are more fully described in Chapter 2, Alternatives.

Impact AQ#9: Continuous Permanent Direct Impacts on Air Quality in the SFBAAB, NCCAB, and SJVAB

Operation of the project has the potential to reduce long-term air quality emissions in the Northern California region. The project would increase passenger rail ridership, and it is anticipated that people would shift trips from on-road vehicles and aircraft to the HSR system, which is less emissions-intensive than other transportation modes. Criteria pollutant emissions and reductions generated by project operations were quantified for 2015, 2029, and 2040 to capture changes in ridership and regional emission factors.

Table 3.3-22 through Table 3.3-24 summarize the estimated net regional emissions changes due to HSR operations under the medium and high ridership scenarios relative to 2015 Existing and 2029 and 2040 No Project conditions, respectively. From an operations perspective, ridership and associated emissions changes from on-road vehicles, aircraft, and power plants (used to generate electricity to power the HSR system) would be identical among the four project alternatives. These emissions changes would occur throughout the Northern California region. Fugitive dust emissions along the project corridor from train movement would vary by project alternative based on the length of the at-grade track. Similarly, emissions from operation of the stations and maintenance facilities would differ among the alternatives based on which facilities are built and operated. Emissions from the stations and maintenance facilities would occur locally at the building locations, which are predominantly in the BAAQMD. Refer to the Air Quality and Greenhouse Gases Technical Report (Volume 2, Appendix 3.3-A) for detailed emissions results by individual source (e.g., on-road vehicles, stations).

Table 3.3-22 Summary of Regional Criteria Pollutant Emissions Changes from Project Operations (under the Medium and High Ridership Scenarios) Relative to the 2015 Existing Conditions (tons per year)

Emission Source	VOC (tons/yr)		CO (tons/yr)		NO_X (tons/yr)		SO_2 (tons/yr)		PM_{10} (tons/yr)		$PM_{2.5}$ (tons/yr)	
	M	H	M	H	M	H	M	H	M	H	M	H
Indirect Emissions												
On-road vehicles	(17)	(23)	(632)	(858)	(72)	(98)	(2)	(2)	(48)	(66)	(13)	(18)
Aircraft	(40)	(38)	(341)	(326)	(328)	(314)	(35)	(34)	(10)	(9)	(10)	(9)
Power plants	2	2	24	26	12	13	1	2	3	3	3	3
Direct Emissions[1]												
Alternative 1												
Stations[2]	2		24		3		<1		4		1	
Maintenance facilities	2		14		12		<1		2		1	
Train movement[3]									8		1	
Alternative 2												
Stations[2]	2		24		3		<1		4		1	
Maintenance facilities	2		14		12		<1		2		1	
Train movement[3]									16		2	
Alternative 3												
Stations[2]	3		25		3		<1		5		1	
Maintenance facilities	2		14		12		<1		2		1	
Train movement[3]									9		1	
Alternative 4												
Stations[2]	2		24		3		<1		4		1	
Maintenance facilities	2		14		12		<1		2		1	
Train movement[3]									18		3	

Emission Source	VOC (tons/yr)		CO (tons/yr)		NO_X (tons/yr)		SO_2 (tons/yr)		PM_{10} (tons/yr)		$PM_{2.5}$ (tons/yr)	
	M	H	M	H	M	H	M	H	M	H	M	H
Total Emissions[4]												
Alternative 1	(50)	(54)	(911)	(1,120)	(372)	(383)	(35)	(34)	(41)	(58)	(17)	(21)
Alternative 2	(50)	(54)	(911)	(1,120)	(372)	(383)	(35)	(34)	(34)	(50)	(16)	(20)
Alternative 3	(50)	(54)	(910)	(1,119)	(372)	(383)	(35)	(34)	(39)	(56)	(17)	(21)
Alternative 4	(50)	(54)	(911)	(1,120)	(372)	(383)	(35)	(34)	(32)	(48)	(16)	(20)

Source: Authority 2020
Parentheses () indicate negative values.
[1] Direct emissions do not depend on ridership; emissions are the same for the medium and high ridership scenarios.
[2] Represents the net emissions effect of the project (i.e., the difference in station operating emissions between existing and existing plus project conditions)
[3] Train movement would only generate fugitive dust emissions.
[4] Total includes indirect and direct emissions.
CO = carbon monoxide
H = high
M = medium
NO_X = nitrogen oxides
PM_{10} = particulate matter 10 microns or less in diameter
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compound
yr = year

Table 3.3-23 Summary of Total Regional Criteria Pollutant Emissions Changes from Project Operations (under the Medium and High Ridership Scenarios) Relative to the 2029 No Project Alternative (tons per year)

Emission Source	VOC (tons/yr)		CO (tons/yr)		NO_X (tons/yr)		SO_2 (tons/yr)		PM_{10} (tons/yr)		$PM_{2.5}$ (tons/yr)	
	M	H	M	H	M	H	M	H	M	H	M	H
Indirect Emissions												
On-road vehicles	(2)	(3)	(157)	(212)	(14)	(18)	(1)	(1)	(36)	(49)	(10)	(13)
Aircraft	(26)	(28)	(216)	(237)	(213)	(233)	(23)	(25)	(6)	(7)	(6)	(7)
Power plants	1	2	20	22	10	11	1	1	2	3	2	2
Direct Emissions[1]												
Alternative 1												
Stations[2]	1		10		1		<1		5		1	
Maintenance facilities	2		11		7		<1		1		<1	
Train movement[3]									8		1	
Alternative 2												
Stations[2]	1		10		1		<1		5		1	
Maintenance facilities	2		11		7		<1		1		<1	
Train movement[3]									16		2	
Alternative 3												
Stations[2]	2		12		1		<1		7		2	
Maintenance facilities	2		11		7		<1		1		<1	
Train movement[3]									9		1	
Alternative 4												
Stations[2]	1		10		1		<1		5		1	
Maintenance facilities	2		11		7		<1		1		<1	
Train movement[3]									18		3	

Emission Source	VOC (tons/yr)		CO (tons/yr)		NO_X (tons/yr)		SO_2 (tons/yr)		PM_{10} (tons/yr)		$PM_{2.5}$ (tons/yr)	
	M	H	M	H	M	H	M	H	M	H	M	H
Total Emissions[4]												
Alternative 1	(23)	(26)	(332)	(406)	(208)	(232)	(22)	(24)	(25)	(38)	(11)	(15)
Alternative 2	(23)	(26)	(332)	(406)	(208)	(232)	(22)	(24)	(18)	(31)	(10)	(13)
Alternative 3	(23)	(26)	(330)	(404)	(208)	(232)	(22)	(24)	(23)	(36)	(10)	(14)
Alternative 4	(23)	(26)	(332)	(406)	(208)	(232)	(22)	(24)	(16)	(29)	(9)	(13)

Source: Authority 2020
Parentheses () indicate negative values.
[1] Direct emissions do not depend on ridership; emissions are the same for both ridership scenarios.
[2] Represents the net emissions effect of the project (i.e., the difference in station operating emissions between 2029 No Project and 2029 Plus Project conditions)
[3] Train movement would only generate fugitive dust emissions.
[4] Total includes indirect and direct emissions.
CO = carbon monoxide
H = high
M = medium
NO_X = nitrogen oxide
PM_{10} = particulate matter 10 microns or less in diameter
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compound
yr = year

Table 3.3-24 Summary of Total Regional Criteria Pollutant Emissions Changes from Project Operations (under the Medium- and High-Ridership Scenarios) Relative to the 2040 No Project Alternative (tons per year)

Emission Source	VOC (tons/yr)		CO (tons/yr)		NO_X (tons/yr)		SO_2 (tons/yr)		PM_{10} (tons/yr)		$PM_{2.5}$ (tons/yr)	
	M	H	M	H	M	H	M	H	M	H	M	H
Indirect Emissions												
On-road vehicles	(3)	(3)	(191)	(247)	(15)	(20)	(1)	(2)	(66)	(83)	(17)	(21)
Aircraft	(55)	(53)	(459)	(440)	(452)	(433)	(49)	(47)	(14)	(13)	(14)	(13)
Power plants	2	2	24	26	12	13	1	2	3	3	3	3
Direct Emissions[1]												
Alternative 1												
Stations[2]	2		19		2		<1		14		4	
Maintenance facilities	2		10		6		<1		1		<1	
Train movement[3]									8		1	
Alternative 2												
Stations[2]	2		19		2		<1		14		4	
Maintenance facilities	2		10		6		<1		1		<1	
Train movement[3]									16		2	
Alternative 3												
Stations[2]	2		21		2		<1		16		4	
Maintenance facilities	2		10		6		<1		1		<1	
Train movement[3]									9		1	
Alternative 4												
Stations[2]	2		19		2		<1		14		4	
Maintenance facilities	2		10		6		<1		1		<1	
Train movement[3]									18		3	

Emission Source	VOC (tons/yr)		CO (tons/yr)		NO_X (tons/yr)		SO_2 (tons/yr)		PM_{10} (tons/yr)		$PM_{2.5}$ (tons/yr)	
	M	H	M	H	M	H	M	H	M	H	M	H
Total Emissions[4]												
Alternative 1	(52)	(50)	(597)	(631)	(447)	(432)	(48)	(46)	(53)	(69)	(23)	(26)
Alternative 2	(52)	(50)	(597)	(631)	(447)	(432)	(48)	(46)	(45)	(61)	(22)	(25)
Alternative 3	(52)	(50)	(595)	(629)	(447)	(432)	(48)	(46)	(50)	(66)	(23)	(26)
Alternative 4	(52)	(50)	(597)	(631)	(447)	(432)	(48)	(46)	(43)	(59)	(22)	(25)

Source: Authority 2020
Parentheses () indicate negative values.
[1] Direct emissions do not depend on ridership; emissions are the same for both ridership scenarios.
[2] Represents the net emissions effect of the project (i.e., the difference in station operating emissions between 2040 No Project and 2040 Plus Project conditions)
[3] Train movement would only generate fugitive dust emissions.
[4] Total includes indirect and direct emissions.
CO = carbon monoxide
H = high
M = medium
NO_X = nitrogen oxides
PM_{10} = particulate matter 10 microns or less in diameter
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compound
yr = year

As shown in Table 3.3-22 through Table 3.3-24, project operations under both ridership scenarios would increase criteria pollutant emissions from additional electricity required to power the HSR system, as well as from operation of the stations and maintenance facilities, relative to the 2015 Existing and 2029 and 2040 No Project conditions. Fugitive dust emissions would also increase as a result of train movement over the track. Electricity demands and the associated emissions from power plants would be identical among the alternatives. Fugitive dust emissions from train movement would be slightly greater under Alternative 4 because it would include more at-grade/embankment miles of track compared to the other project alternatives. Station and maintenance facility emissions would be similar among all four alternatives, but slightly higher under Alternative 3, which would include the East Gilroy Station. Because the East Gilroy Station would be entirely new, emissions under existing conditions would be zero and, as a result, net emissions would be greater than the Downtown Gilroy Station (proposed under Alternatives 1, 2, and 4).

While project operations would increase criteria pollutants associated with power plants, train movement, stations, and maintenance facilities, it would result in sizeable emissions reductions from on-road vehicles and aircraft relative to the 2015 Existing and 2029 and 2040 No Project conditions. These emissions benefits would be achieved by reductions in single-occupancy vehicle trips and aircraft activity; with a greater number of people traveling on the HSR system, fewer vehicle and aircraft trips would occur. Since the reductions in on-road vehicles and aircraft activity are directly tied to ridership, there would be no difference in emissions benefits among the project alternatives. It should be noted that the emission savings due to reduced VMT are conservative because they do not consider the recently enacted SAFE Vehicles Rule. The SAFE Vehicles Rule increases criteria pollutant emission rates for light duty gasoline-powered vehicles. As such, applying the SAFE Vehicles Rule would increase the benefits of the HSR VMT reductions by as much as 4 percent for certain criteria pollutants in 2040 (CARB 2019a). Nonetheless, the criteria pollutant reductions achieved by changes in on-road vehicles and aircraft activity would more than offset the emissions increase from project operations (electricity, train movement, stations, and maintenance facilities). Long-term operations of all project alternatives and the larger HSR system would, therefore, result in a net reduction in operational emissions from the 2015 Existing and 2029 and 2040 No Project conditions.

CEQA Conclusion

The impact would be less than significant under CEQA for all alternatives because project operations are anticipated to result in a net reduction of criteria pollutant emissions relative to 2015 existing conditions and in future years relative to the No Project conditions. Project operations would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. Reductions in regional ozone precursors (VOC and NOx) and PM emissions may contribute to reductions in ozone and secondary PM formation, which may result in public health benefits, including reductions in lost workdays, hospital admissions, and certain respiratory and cardiovascular symptoms. Therefore, CEQA does not require mitigation.

Impact AQ#10: Continuous Permanent Direct Impacts on Implementation of an Applicable Air Quality Plan

During operations, all four project alternatives would result in net decreases in all criteria pollutant emissions (VOC, CO, NO_X, SO_2, PM_{10} and $PM_{2.5}$) when compared to 2015 Existing and 2029 and 2040 No Project conditions, as shown in Table 3.3-22 through Table 3.3-24. This would be consistent with the BAAQMD's, MBARD's, and SJVAPCD's air quality plans, as well as the local RTPs. Therefore, project operations would not conflict with or obstruct implementation of applicable air quality plans.

CEQA Conclusion

The impact would be less than significant under CEQA because operations of the project would result in net decreases in all criteria pollutant emissions relative to the 2015 existing conditions. As a result, project operations would not conflict with or obstruct implementation of applicable air quality plans. Therefore, CEQA does not require mitigation.

Impact AQ#11: Continuous Permanent Direct Impacts on Localized Air Quality—Carbon Monoxide Hot Spots (NAAQS Compliance)

Analysts modeled CO concentrations at five intersections identified in the traffic analysis as having the highest station traffic volumes and the worst levels of congestion/delay of those analyzed for the project covered by CMPs. In addition to these locations, the intersection of Monterey Road and Skyway Drive was analyzed under Alternative 4, which would require an at-grade crossing. Alternatives 1 through 3 would not worsen traffic conditions at this or other intersections along the alignment because the alignment and roadways would be grade separated.

The modeled CO concentrations were adjusted to reflect the impact of the SAFE Vehicle Rule (CARB 2019a) and were combined with CO background concentrations. The total ambient CO concentrations were then compared with air quality standards. Table 3.3-25 shows the CO hot-spot analysis results, which indicate that CO concentrations are not anticipated to exceed the 1- or 8-hour NAAQS and CAAQS. Traffic volumes would not differ significantly among the project alternatives at the five station intersections; consequently, most of the results presented in Table 3.3-25 are representative of all four project alternatives. The results for Monterey Road/Skyway Drive are only applicable to Alternative 4.

CEQA Conclusion

The impact would be less than significant under CEQA for all alternatives because the project would not create traffic conditions that would result in localized CO hot spots. As a result, the project would not result in CO concentrations in excess of the health protective CAAQS or NAAQS, and as such, would not expose sensitive receptors to significant pollutant concentrations or health effects. Therefore, CEQA does not require mitigation.

This page intentionally left blank

Table 3.3-25 Carbon Monoxide Modeling Concentration Results (parts per million)

Intersection	Rec.[1]	1-Hour Concentration[2]						8-Hour Concentration[3]					
		Existing (2015)		Future (2029)		Future (2040)		Existing (2015)		Future (2029)		Future (2040)	
		No Project	Plus Project	No Project	Plus Project	No Project	Plus Project	No Project	Plus Project	No Project	Plus Project	No Project	Plus Project
The Alameda (SR 82)/Taylor Street-Naglee Avenue	1	3.7	3.7	3.0	3.0	3.0	3.0	2.8	2.8	2.3	2.3	2.3	2.3
	2	3.7	3.7	2.9	2.9	2.9	3.0	2.8	2.8	2.2	2.2	2.2	2.3
	3	4.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0	2.3	2.3	2.3	2.3
	4	3.6	3.6	2.9	2.9	3.0	3.0	2.7	2.7	2.2	2.2	2.3	2.3
Autumn Street (SR 82)/West Santa Clara Street (SR 82)	5	3.1	3.2	2.8	2.8	2.9	2.9	2.4	2.4	2.1	2.1	2.2	2.2
	6	3.2	3.2	2.8	2.9	2.8	2.9	2.4	2.4	2.1	2.2	2.1	2.2
	7	2.9	3.0	2.7	2.8	2.9	3.0	2.2	2.3	2.0	2.1	2.2	2.3
	8	3.1	3.2	2.8	2.8	2.9	3.0	2.4	2.4	2.1	2.1	2.2	2.3
Coleman Avenue/I-880 Northbound Ramps	9	3.8	3.9	2.9	2.9	2.9	2.9	2.9	2.9	2.2	2.2	2.2	2.2
	10	4.2	4.3	3.0	3.1	3.0	3.1	3.1	3.2	2.3	2.3	2.3	2.4
	11	4.0	4.0	2.9	3.0	3.0	3.0	3.0	3.0	2.2	2.3	2.3	2.3
	12	4.4	4.5	3.1	3.1	3.1	3.1	3.3	3.3	2.3	2.3	2.4	2.4
Monterey Road (SR 82)/Blossom Hill Road Westbound Ramps (SR 82/CR G10)	13	3.6	3.6	2.9	2.8	2.7	3.0	2.7	2.7	2.2	2.1	2.1	2.3
	14	3.7	3.7	3.0	2.9	2.8	3.0	2.8	2.8	2.3	2.2	2.1	2.3
	15	3.7	3.8	3.0	2.8	2.6	3.0	2.8	2.9	2.3	2.1	2.0	2.3
	16	3.8	3.8	3.0	2.9	2.9	3.0	2.9	2.9	2.3	2.2	2.2	2.3
US 101 Southbound Ramps/Blossom Hill Road	17	4.7	4.6	3.1	3.1	3.1	3.1	3.5	3.4	2.3	2.3	2.4	2.4
	18	5.0	5.1	3.3	3.3	3.3	3.3	3.7	3.8	2.5	2.5	2.5	2.5
	19	4.2	4.3	3.0	3.0	3.0	3.0	3.1	3.2	2.3	2.3	2.3	2.3
	20	4.2	4.3	3.0	3.0	3.0	3.0	3.1	3.2	2.3	2.3	2.3	2.3
Monterey Road/Skyway Drive (Alternative 4 only)	21	3.7	3.7	3.0	3.0	3.0	3.0	2.8	2.8	2.3	2.3	2.3	2.3
	22	4.4	4.4	2.9	2.9	2.9	3.0	3.3	3.3	2.2	2.2	2.2	2.3
	23	3.8	3.8	3.0	3.0	3.0	3.0	2.9	2.9	2.3	2.3	2.3	2.3
	24	4.5	4.5	2.9	2.9	3.0	3.0	3.3	3.3	2.2	2.2	2.3	2.3
State standard (ppm)		20	20	20	20	20	20	9	9	9	9	9	9
Federal standard (ppm)		35	35	35	35	35	35	9	9	9	9	9	9

[1] Consistent with the Caltrans CO Protocol, receptors are located at 3 meters from the intersection, at each of the four corners to represent the nearest location in which a receptor could potentially be located adjacent to a traveled roadway. The modeled receptors indicated are not representative of the actual sensitive receptors. Receptor locations are theoretical and are not reflective of the actual locations shown on Figure 3.3-4 through Figure 3.3-7.
[2] Average 1-hour background concentration between 2015 and 2017 was 2.13 ppm (USEPA 2018a).
[3] Average 8-hour background concentration between 2015 and 2017 was 1.67 ppm (USEPA 2018a).
Caltrans = California Department of Transportation
CO = carbon monoxide
CR = county road
ppm = parts per million
SR = State Route
US = U.S. Highway
USEPA = U.S. Environmental Protection Agency

This page intentionally left blank

Impact AQ#12: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Mobile Source Air Toxics

The project would decrease regional VMT and MSAT emissions relative to 2015 Existing and 2029 and 2040 No Project conditions. The HSR system would reduce the number of individual vehicle trips on a regional basis. Because the project would not change the regional traffic mix, the amount of MSATs emitted from highways and other roadways within the RSA would be proportional to the VMT. The regional VMT estimated for the project would be less than the anticipated VMT under 2015 Existing and 2029 and 2040 No Project conditions, and therefore MSAT emissions from regional vehicle traffic would be less for the project. Regionally, the project would be considered a project with "no meaningful MSAT effects" (Tier 1), per FHWA's (2016) MSAT guidance. Reductions in regional MSAT emissions may result in public health benefits, including reductions in lost work days, hospital admissions, and certain respiratory and cardiovascular symptoms.

While reductions in regional MSATs are expected because of decreased VMT, localized increases in MSAT emissions could occur near the stations and maintenance facilities, because of additional passenger and employee commute trips. These increases would not be considered to have "higher potential MSAT effects" per FHWA guidance since the anticipated change in local average daily traffic would not exceed the FHWA's MSAT trigger of 140,000 average daily traffic. Locally, the project would be considered a project with "low MSAT effects" (Tier 2), per FHWA's (2016) MSAT guidance. Consistent with this guidance, the magnitude and the duration of potential changes in localized MSAT emissions, and thus health consequences, cannot be reliably quantified because of incomplete or unavailable information in forecasting project-specific health impacts. Even though there may be differences among the project alternatives with respect to localized MSATs, USEPA's vehicle and fuel regulations, coupled with fleet turnover, would cause MSAT reductions over time, thereby offsetting the increase in localized traffic associated with the project.

CEQA Conclusion

The impact would be less than significant under CEQA for all alternatives because the project would not result in an increase in MSAT emissions that would expose sensitive receptors to substantial pollutant concentrations. Consistent with FHWA guidance, the project would have no meaningful regional MSAT impacts and would have a low potential for meaningful localized MSAT impacts. Therefore, CEQA does not require mitigation.

Impact AQ#13: Continuous Permanent Direct Impacts on Localized Air Quality—Particulate Matter Hot Spots (NAAQS Compliance)

Portions of the RSA are designated nonattainment for $PM_{2.5}$ and maintenance for PM_{10}. In accordance with USEPA guidance, if a project meets one of several criteria, it is considered a project of air quality concern, and a quantitative $PM_{10}/PM_{2.5}$ analysis is required. The criteria, along with an evaluation of their applicability to the project alternatives, are as follows:

- *New or expanded highway projects that have a significant number of or significant increase in diesel vehicles*—The project is not a new highway project, nor would it expand an existing highway beyond its current capacity. The HSR system would be electrically powered. While the project would affect traffic conditions on roadways near the stations, it would not measurably affect truck volumes on the affected roadways. Most vehicle trips entering and leaving the station location would be passenger vehicles, which are typically not diesel-powered, except for delivery truck trips to support station activities. Furthermore, the project would improve regional traffic conditions by reducing traffic congestion and regional VMT in the RSA and increasing vehicle speeds.
- *Projects affecting intersections that are at LOS D, E, or F with a significant number of diesel vehicles or those that will degrade to LOS D, E, or F because of increased traffic volumes from a significant number of diesel vehicles related to the project*—The project would not change the existing traffic mix at signalized intersections. Although the maintenance facilities would use diesel vehicles, daily deliveries are not expected to exceed 20 trips. In some cases, the LOS of intersections near the HSR stations or at at-grade crossings (Alternative 4

only) would be degraded to LOS F under the project alternatives. However, the traffic volume increases at the affected intersections would be primarily from passenger cars and transit buses used for transporting people to or from the stations. Passenger cars would be mostly gasoline-powered. Buses operated by VTA are a mix of diesel- and diesel-electric–powered vehicles. Pursuant to the Innovative Clean Transit Regulation, VTA's bus fleet would comprise only zero-emission vehicles by 2040. While diesel-powered buses would still operate as part of VTA's future vehicle fleet until that time, they would not represent a significant (i.e., less than 5 percent) portion of local traffic.

- *New or expanded bus and rail terminals and transfer points that have a significant number of diesel vehicles congregating at a single location*—The trains used for the project would be EMUs, powered by electricity, not diesel fuel. Most vehicle trips entering and leaving the stations would be passenger vehicles, which are not typically diesel-powered.[18]

  Alternatives 1, 2, and 4 would not have new or expanded bus or rail passenger terminals or transfer points that would significantly increase the number of diesel vehicles congregating at a single location. Improved bus service at the San Jose Diridon and Downtown Gilroy Stations would not be part of the HSR system. The Authority assumes that bus service levels at these locations would be constant into the future because no operator has a funding plan to deliver more service. VTA would transition to a to zero-emissions bus fleet, which would reduce emissions over time.

  While bus service levels are assumed to be the same with and without the project, the East Gilroy Station under Alternative 3 would be an entirely new transit stop with HSR conditions. The project would generate approximately 107 shuttle/bus trips per day at the East Gilroy Station in the year 2029. These trips would be made by a combination of diesel, diesel-electric, and fully electric buses. While the diesel-powered buses would generate DPM along the bus access route (Leavesley Road) and during passenger loading and unloading, the emissions would be minor, totaling less than 0.0012 pounds of PM_{10} per day. The 107 additional bus trips would represent less than 1.5 percent of average daily traffic on Leavesley Road (Burton 2019]). Accordingly, the East Gilroy Station would not significantly increase the number of diesel vehicles congregating at a single location in the near-term. By 2040, all transit buses at the East Gilroy Station would be zero-emissions vehicles, pursuant to the Innovative Clean Transit Regulation.

- *Projects in, or affecting, locations, areas, or categories of sites that are identified in the $PM_{2.5}$- or PM_{10}-applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation*—The RSA is not in an area identified as sites of violation or possible violation in the USEPA-approved SIP.

As a result, none of the project alternatives were determined to be a project of air quality concern, as defined by 40 C.F.R. Section 93.123(b)(1), and likely would not cause violation of PM_{10}/$PM_{2.5}$ health-protective NAAQS or any localized impact with respect to PM on sensitive receptors during its operations. Thus, CAA 40 C.F.R. Section 93.116 requirements would be met without a quantitative hot-spot analysis.

CEQA Conclusion

The impact would be less than significant under CEQA for all alternatives because the project is not considered to be a project of air quality concern, based on the descriptions in 40 C.F.R. Section 93.123(b)(1). Changes in on-road vehicle operation associated with project operations would not contribute to new or worsened violations of the health-protective NAAQS. As such, localized changes in PM emissions from on-road vehicles would not be expected to contribute a significant level of air pollution such that individuals would be exposed to substantial PM concentrations. Therefore, CEQA does not require mitigation.

[18] While not a bus or rail terminal, the maintenance facilities would also have diesel vehicles, but these would be limited to 20 or fewer haul vehicles per day. Likewise, locomotives used to support maintenance activities at the MOWF would be used between 24 and 210 hours per year, depending on function.

Impact AQ#14: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Diesel Particulate Matter and $PM_{2.5}$ (Health Risk)

Relocated freight service would be the same under all project alternatives without the DDV and has the potential to create increased inhalation health risks and exposure to $PM_{2.5}$, which may exceed local significance thresholds for cancer and noncancer hazards at analyzed receptor locations adjacent to the relocated track. The track shift under Alternative 4 with the DDV would move freight operations approximately 37 feet closer to receptors off West Julian Street and North Montgomery Street, which would put them closer to diesel particulate emissions from freight trains and could increase their health risk. The minor track shifts in the station area and south of the station would not include a shift of MT-1, which is the dedicated freight track. There would be no changes in operational emissions or locations with the TDV. Health risks to the closest receptors along relocated track sections were estimated using the BAAQMD's rail inventory tool and the methods described in Section 3.3.4.3, Methods for Impacts Analysis.

Table 3.3-26 shows the incremental change in health risks between the project and existing and No Project conditions. The analysis assumes that freight relocation would be complete in 2022. Accordingly, emissions exposure under the relocated freight scenario and No Project conditions was assumed to begin in 2022. Existing conditions reflects the risks that would occur if the freight tracks were not relocated and exposure to emissions began in 2015.

As shown in Table 3.3-26, relocated freight service would generally both decrease and increase cancer and noncancer health risks, relative to existing conditions, depending on location. The decreases would occur primarily because of advancements in locomotive emissions technology and the retirement of older, higher-emitting engines, which would reduce future DPM emission rates. The reduction in future locomotive emission rates is enough to offset the increased risk associated with relocating freight service closer to existing receptors. Where risks would increase, the reduction in locomotive emission rates would not be enough to offset the increased risk associated with relocating freight service closer to existing receptors.

The comparison of relocated risks to No Project conditions accounts for changes in locomotive emission rates because both conditions assume exposure begins in 2022. Accordingly, the comparison reflects the incremental project impact, exclusive of background trends. As shown in Table 3.3-26, relative to No Project conditions, relocating freight service closer to sensitive receptors would increase cancer and noncancer health risks at modeled receptor locations. However, these increases, including increases under Alternative 4 with the DDV, would not exceed BAAQMD thresholds. Table 3.3-26 only evaluates locations where freight would be moved closer to receptors. In many of these locations, receptors on the other side of the track would observe a corresponding health benefit because freight would be moved further away from these receptors.

The San Jose Diridon Station under all alternatives and the Downtown Gilroy Station under Alternatives 1, 2, and 4 would have emergency generators for use in the event of a power outage. The generators would comply with the permitting requirements specified in BAAQMD Regulation 2, Rule 5, which prohibits their operation if cancer or acute hazards exceed air district thresholds. Regulation 2, Rule 5 does not establish any permit restrictions on $PM_{2.5}$ concentrations in the BAAQMD. Accordingly, the Authority only estimated $PM_{2.5}$ exhaust concentrations from emergency generator testing because cancer and hazards would be below air district thresholds.

The East Gilroy Station under Alternative 3 would also operate an emergency generator and would serve diesel-powered buses under 2029 conditions (by 2040, all buses will be net zero emissions per state regulation). Health risks from transit buses are not subject to permit restrictions, and as such, the analysis of health risks at the East Gilroy Station evaluates cancer risk, hazards, and $PM_{2.5}$ concentrations.

The MOWF would operate an emergency generator and use diesel-powered off-road equipment, vehicles, and locomotives to support maintenance and repair activities. The analysis of cancer and noncancer health risks, as well as $PM_{2.5}$ concentrations, at the MOWF includes emissions from all these sources.

Table 3.3-26 Summary of Changes in Cancer and Noncancer Health Risks from Freight Relocation Relative to Existing and No Project Conditions

General Location	Change in Exposure with the Freight Relocation Relative to Exposure under Existing Conditions[1]			Change in Exposure with the Freight Relocation Relative to Exposure under No Project Conditions[2]		
	Cancer	Chronic HI	$PM_{2.5}$ (µg/m³)	Cancer	Chronic HI	$PM_{2.5}$ (µg/m³)
Repositions under Alternatives 1 through 3						
Near Monterey Road and Blanchard Road	(3.9)	<0.0	<0.0	<0.1	<0.1	<0.1
Between Monterey Road and Crowner Avenue	(0.1)	<0.0	<0.0	1.8	<0.1	<0.1
Near Monterey Road and California Avenue	1.2	<0.1	<0.1	3.7	<0.1	<0.1
Near Monterey Road and Ronan Avenue	(0.2)	<0.0	<0.0	0.9	<0.1	<0.1
Near Monterey Road and Leavesley Road	0.0	<0.0	<0.0	0.8	<0.1	<0.1
Near Monterey Road and 1st Street	1.8	<0.1	<0.1	3.3	<0.1	<0.1
Near Monterey Road and W 10th Street	1.3	<0.1	<0.1	2.3	<0.1	<0.1
Repositions under Alternative 3 Only						
Near Pacheco Court and Frazier Lake Road	4.9	<0.1	<0.1	5.0	<0.1	<0.1
Repositions under Alternative 4 Only						
Near Chestnut Street and Asbury Street	(17.2)	<0.0	<0.0	5.2	<0.1	<0.1
Near Harrison Street and Fuller Avenue	(3.9)	<0.0	<0.0	5.6	<0.1	<0.1
Near Cross Way and Northern Road	(1.9)	<0.0	<0.0	0.6	<0.1	<0.1
End of Promme Court	(3.4)	<0.0	<0.0	0.8	<0.1	<0.1
Near Prindiville Drive and Urshan Way	(0.6)	<0.0	<0.0	2.4	<0.1	<0.1
Near Madrone Avenue and Dougherty Avenue	(0.2)	<0.0	<0.0	1.9	<0.1	<0.1
Near Butterfield Blvd and E Dunne Avenue	(0.7)	<0.0	<0.0	0.1	<0.1	<0.1
End of Sister City Way	(0.6)	<0.0	<0.0	0.4	<0.1	<0.1

General Location	Change in Exposure with the Freight Relocation Relative to Exposure under Existing Conditions[1]			Change in Exposure with the Freight Relocation Relative to Exposure under No Project Conditions[2]		
	Cancer	Chronic HI	$PM_{2.5}$ ($\mu g/m^3$)	Cancer	Chronic HI	$PM_{2.5}$ ($\mu g/m^3$)
Near Garlic Farms Drive and Travel Park Circle	(0.3)	<0.0	<0.0	0.4	<0.1	<0.1
Near Bolsa Road	0.4	<0.1	<0.1	1.1	<0.1	<0.1
Near West Julian Street and North Montgomery Street[3]	(12.8)	<0.0	<0.0	8.4	<0.1	<0.1
Threshold	**10.0**	**1.0**	**0.3**	**10.0**	**1.0**	**0.3**

Parenthesis () indicate negative values.
[1] Existing conditions reflects the risks that would occur if the freight tracks were not relocated and exposure to emissions began in 2015.
[2] No Project conditions reflects the risks that would occur if the freight tracks were not relocated and exposure to emissions began in 2022.
[3] The track shift near West Julian Street and North Montgomery Street would only occur under Alternative 4 with the DDV.
< = less than
$\mu g/m^3$ = micrograms per cubic meter
HI = hazard index
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter

Table 3.3-27 shows the results of the health risks analysis at the project stations and the East Gilroy MOWF.[19, 20] Health risks and maximum $PM_{2.5}$ concentrations would be less than BAAQMD's health risk thresholds of significance for all four project alternatives.

Table 3.3-27 Maximum Health Risks and $PM_{2.5}$ Concentrations from Project Station and MOWF Operations[1]

Location/Condition	Cancer	Chronic HI	Maximum $PM_{2.5}$ Concentration (µg/m³)
2015 Existing/2029 and 2040 No Project[2]			
San Jose Diridon Station	<10	<1.0	<0.1
Downtown Gilroy Station	<10	<1.0	<0.1
2029/2040 Plus Project[3]			
San Jose Diridon Station (Alternatives 1, 2, 3, 4)[4]	<10	<1.0	<0.1
Downtown Gilroy Station (Alternatives 1, 2, 4)[5]	<10	<1.0	<0.1
East Gilroy Station (Alternative 3)	<1	<0.1	<0.1
East Gilroy MOWF (Alternative 3)[6]	3	<0.1	<0.1
Project vs. Existing and No Project Conditions[7]			
San Jose Diridon Station (Alternatives 1, 2, 3, 4)[4]	<10	<1.0	<0.1
Downtown Gilroy Station (Alternatives 1, 2, 4)[5]	<10	<1.0	<0.1
East Gilroy Station (Alternative 3)	<1	<0.1	<0.1
East Gilroy MOWF (Alternative 3)[6]	3	<0.1	<0.1
Threshold	**10**	**1.0**	**0.3**

[1] The Los Banos MOWS is not analyzed because this facility would be located within the SJVAPCD, which does not have a $PM_{2.5}$ threshold. SJVAPCD does not issue permits for projects that create a significant cancer or non-cancer health risk.
[2] The San Jose Diridon and Downtown Gilroy Stations were assumed to operate one emergency generator under existing conditions. The East Gilroy Station does not exist under existing conditions and, as such, existing emissions are assumed to be zero.
[3] The expanded San Jose Diridon Station was assumed to operate three emergency generators with project implementation. The Downtown Gilroy Station was assumed to operate two emergency generators under project conditions. The East Gilroy Station and MOWF were assumed to operate one generator under project conditions.
[4] There would be no difference in operational emissions or health risk between the aerial and at-grade options.
[5] There would be no difference in operational emissions or health risk between the aerial and embankment options.
[6] There are no receptors within 1,000 feet of the South Gilroy MOWF. Accordingly, a health risk assessment is not required, consistent with BAAQMD (2017a) guidance.
[7] Represents the net concentration effect of the project (i.e., the difference in between the existing/No Project and the project condition).
< = less than
µg/m³ = micrograms per cubic meter
BAAQMD = Bay Area Air Quality Management District
HI = hazard index
MOWS = maintenance of way siding
MOWF = maintenance of way facility
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
SJVAPCD = San Joaquin Valley Air Pollution Control District

[19] The Los Banos MOWS is not analyzed because this facility would be in the SJVAPCD, which does not have a $PM_{2.5}$ threshold. SJVAPCD does not issue permits for projects that create a significant cancer or noncancer health risk (SJVAPCD Rule 2201). Accordingly, cancer and noncancer health risks from generator operation at the Los Banos MOWS would be less than SJVAPCD's health risk thresholds.

[20] There are no receptors within 1,000 feet of the South Gilroy MOWF. Accordingly, a health risk assessment is not required, consistent with BAAQMD (2017a) guidance.

As shown in Table 3.3-27, health risks and $PM_{2.5}$ concentrations at the maximally exposed receptor locations would be less than BAAQMD's health risk thresholds of significance.

CEQA Conclusion

The impact would be less than significant under CEQA for all alternatives, including Alternative 4 with the DDV, because operations-related DPM and $PM_{2.5}$ concentrations associated with the project would not exceed BAAQMD's cancer and noncancer risk thresholds. Therefore, CEQA does not require mitigation.

Impact AQ#15: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Odors

The HSR trains would be powered from the regional electrical grid and operations would not result in potentially odorous emissions. There would be some area source emissions associated with station and maintenance facility operation, such as natural-gas combustion for space and water heating, landscaping equipment emissions, and solvent and paint use during the periodic reapplication of exterior coatings, which would be the same under all four project alternatives. The solvent and paint use would have the potential to be odorous sources to sensitive receptors in some areas. However, any potential odor emissions would occur within an existing commercial and industrial area and would not represent new or unique odors, relative to those under the No Project Alternative.

CEQA Conclusion

The impact would be less than significant under CEQA because odors generated during operations would not be expected to affect a substantial number of people or result in nuisance complaints. Therefore, CEQA does not require mitigation.

3.3.6.2 Greenhouse Gases

Long-term project operations would result in a net reduction of regional and statewide GHG emissions when compared to 2015 Existing and 2029 and 2040 No Project conditions. Project construction would result in the short-term generation of GHG emissions. However, net GHG reductions during operations (because of reduced car and aircraft trips in Northern California and statewide) would offset the increase in construction-related GHG emissions within approximately 8 to 14 months. Accordingly, implementation of the project would result in a net decrease in GHG emissions, which would be beneficial to the RSA and the state of California and would help meet local and statewide GHG reduction goals.

No Project Impacts

As discussed in Section 3.3.6.1, Air Quality, reasonably foreseeable projects throughout Northern California and the San Joaquin Valley would result in emissions from on-road vehicles, aircraft, and power plant sources. The emissions efficiency of on-road vehicles and aircraft would improve in the future, and these improvements would lower total GHG emissions under the No Project Alternative. Additionally, because of the state requirement that an increasing fraction (100 percent by 2045) of electricity generated for the state's power portfolio come from renewable energy sources, it is likely that the emissions from power plant sources in the future would be lower than existing emissions.

Project Impacts

Construction Impacts

Impact AQ#16: Temporary Direct and Indirect Impacts on Global Climate Change—Greenhouse Gas Emissions

Project construction would generate GHG emissions during the 7-year construction period through the use of heavy-duty construction equipment, construction worker vehicles, truck hauling, helicopters, and electricity. Table 3.3-28 summarizes total estimated GHG emissions associated with project construction. The table reflects the impact of the SAFE Vehicle Rule (CARB 2020b). Emissions have been amortized over a 25-year project life (although the actual project life would be much longer). The emissions results assume implementation of AQ-IAMF#2

through AQ-IAMF#5 (AQ-IAMF#1 and AQ-IAMF#6 will not affect GHG emissions). However, because the commercial availability of future electric equipment and vehicles is unknown, emissions reductions achieved by AQ-MM#2 cannot currently be quantified or included in the analysis. Refer to the Air Quality and Greenhouse Gases Technical Report (Volume 2, Appendix 3.3-A) for annual emission results.

Table 3.3-28 Comparison of Total Carbon Dioxide Equivalent Emissions from Construction of the Project Alternatives (metric tons)[1, 2, 3]

Alternative	BAAQMD	MBARD	SJVAPCD
Alternative 1	216,845	15,399	139,508
Total Across All Air Districts	371,752		
Alternative 2	298,447	27,917	139,508
Total Across All Air Districts	465,635		
Alternative 3	222,993	14,538	139,508
Total Across All Air Districts	377,040		
Alternative 4	327,209	34,352	139,508
Total Across All Air Districts	501,070		
Total Amortized GHG Emissions (averaged over 25 years)			
Alternative 1	14,870		
Alternative 2	18,635		
Alternative 3	15,082		
Alternative 4	20,043		
Payback of GHG Emissions (months) for All Alternatives (project vs. 2029 No Project)[4]			
Alternative 1	8 to 10		
Alternative 2	9 to 13		
Alternative 3	8 to 10		
Alternative 4	10 to 14		

[1] Project life is assumed to be 25 years.
[2] Payback periods were estimated by dividing the GHG emissions during construction by the annual GHG emission reduction during project operations.
[3] The construction effort and materials with the DDV and TDV would be approximately the same as the alternatives without the DDV and TDV; therefore, associated GHG emissions would be approximately the same with and without the DDV and TDV.
[4] See Table 3.3-29 for operational GHG emission-reduction data. The range in payback days represents the range of emissions changes based on the medium and high ridership scenarios.
BAAQMD = Bay Area Air Quality Management District
GHG = greenhouse gas
MBARD = Monterey Bay Air Resources District
SJVAPCD = San Joaquin Valley Air Pollution Control District

Table 3.3-28 indicates total amortized GHG construction emissions for the project are estimated to be between 14,870 and 20,043 metric tons carbon dioxide equivalent (CO_2e) per year, with Alternative 4 generating the most emissions, and Alternative 1 generating the least. Most emissions would occur in the BAAQMD (58 percent to 65 percent), followed by SJVAPCD (28 percent to 37 percent), and MBARD (4 percent to 7 percent). The total GHG construction emissions of the project (Alternative 4) would be less than 0.15 percent of the total annual statewide GHG emissions.[21]

Long-term operation of the project would result in a net GHG reduction, relative to the 2015 Existing and 2029 and 2040 No Project conditions. The net GHG reductions achieved by project operations would offset the increase in GHG emissions generated during construction in 8 to 14 months of operations, depending on the alternative.

CEQA Conclusion

The impact would be less than significant under CEQA for all alternatives because emission reductions during operations from reduced auto and aircraft trips would offset the short-term construction-related contribution to increased GHG emissions. Project construction would generate GHG emissions between 2022 and 2028. However, these emissions would be almost fully offset after 8 to 14 months of operations (depending on the ridership scenario and alternative). Shortly following the first year of operations, the project would result in annual emissions reductions and a GHG benefit. Additionally, the project is identified in CARB's AB 32 Scoping Plan and 2017 Scoping Plan Update as a component of a sustainable transportation system, and would be consistent with the state's plan to achieve GHG emissions in the long run. Such GHG reductions would be consistent with statewide goals. Consequently, the project would not impede the state from meeting the statewide GHG emissions reductions target. Therefore, CEQA does not require mitigation.

Operations Impacts

Impact AQ#17: Continuous Permanent Direct and Indirect Impacts on Global Climate Change—Greenhouse Gas Emissions

Project operations have the potential to create long-term GHG impacts through the operation of the stations, maintenance facilities, and new circuit breakers. The project would increase passenger rail ridership, and it is anticipated that people would shift trips from on-road vehicles and aircraft to the HSR system, which is less emissions-intensive than other transportation modes. GHG emissions and reductions generated by project operations were quantified for the 2015, 2029, and 2040 analysis scenarios to capture changes in ridership and regional emission factors.

Table 3.3-29 summarizes the estimated net operational emissions under the medium and high ridership scenarios relative to 2015 Existing and 2029 and 2040 No Project conditions (expressed in terms of CO_2e). From an operations perspective, ridership and associated emissions changes from on-road vehicles, aircraft, and power plants (used to generate electricity to power the HSR system) would be identical among the four project alternatives. Emissions from the operation of the stations and maintenance facilities would differ among the alternatives based on which facilities are built and operated. Emissions from new PG&E circuit breakers would be identical among all project alternatives. Refer to the Air Quality and Greenhouse Gases Technical Report (Volume 2, Appendix 3.3-A) for detailed emissions results by individual source (e.g., on-road vehicles, stations).

[21] A GHG emissions inventory for the project vicinity was not available at the time of the release of this document, so the comparison was made to CARB's 2016 emissions inventory, which estimated that the annual CO_2e emissions in California are about 429 million metric tons (CARB 2018c).

Table 3.3-29 Summary of Statewide Greenhouse Gas Emissions Changes from Project Operations (under the Medium and High Ridership Scenarios) Relative to Existing, 2029, and 2040 No Project Conditions (metric tons CO_2e per year)

Source/Alternative	Medium	High
Existing Plus Project Emissions Relative to 2015 Existing Conditions		
Indirect Emissions		
On-road vehicles	(1,068,252)	(1,468,722)
Aircraft	(700,302)	(673,761)
Power plants[1]	354,637	390,100
Direct Emissions[2]		
Alternative 1	11,248	
Alternative 2	11,248	
Alternative 3	11,450	
Alternative 4	11,248	
Total Emissions[3]	**(1,402,467)**	**(1,740,932)**
2029 Plus Project Emissions Relative to 2029 No Project Conditions		
Indirect Emissions		
On-road vehicles	(448,990)	(274,927)
Aircraft	(455,629)	(503,715)
Power plants[1]	302,803	333,083
Direct Emissions[2]		
Alternative 1	9,233	
Alternative 2	9,233	
Alternative 3	9,981	
Alternative 4	9,233	
Total Emissions[3]	**(591,835)**	**(435,578)**
2040 Plus Project Emissions Relative to 2040 No Project Conditions		
Indirect Emissions		
On-road vehicles	(493,192)	(1,107,479)
Aircraft	(973,283)	(936,397)
Power plants[1]	354,637	390,100

Source/Alternative	Medium	High
Direct Emissions[2]		
Alternative 1	13,811	
Alternative 2	13,811	
Alternative 3	14,594	
Alternative 4	13,811	
Total Emissions[3]	**(1,074,953)**	**(1,614,661)**

Source: Authority 2020
Parenthesis () indicate negative values.
[1] The HSR system is analyzed as if it would be powered by the state's current electric grid. This is a conservative assumption because of the state requirement that an increasing fraction of electricity (60 percent by 2030 and 100 percent by 2045) generated for the state's power portfolio come from renewable energy sources. As such, the emissions from power plants are expected to be lower in the future than the emissions estimated for this analysis. Furthermore, under the 2013 Policy Directive POLI-PLAN-03, the Authority has adopted a goal to purchase 100 percent of the HSR system's power from renewable energy sources.
[2] Sum of station, maintenance facility, and SF_6 circuit breaker emissions. Represents the net emissions effect of the project (i.e., the difference in operating emissions between existing or No Project conditions and the project condition). Station and maintenance facility modeling reflect the impact of the SAFE Vehicle Rule (CARB 2020b).
[3] The total includes the indirect and direct emissions for the alternative (Alternative 3) with the greatest total emissions. Totals may not add up exactly because of rounding.
CO_2e = carbon dioxide equivalent
HSR = high-speed rail
SF_6 = sulfur hexafluoride

As shown in Table 3.3-29, project operations under both the medium and high ridership scenarios would increase indirect GHG emissions from additional electricity required to power the HSR system, as well as direct GHG emissions from operation of the stations, maintenance facilities, and new circuit breakers, relative to the 2015 Existing and 2029 and 2040 No Project conditions. Electricity demands and the associated emissions from power plants would be identical among the alternatives with and without the DDV and TDV. Direct emissions from stations, maintenance facilities, and new circuit breakers would likewise be virtually identical among the alternatives; Alternative 3 would result in slightly greater station emissions from operation of the East Gilroy Station, but the overall difference would not be meaningful in the context of the total emission reductions shown in Table 3.3-29.

While project operations would increase GHG associated with power plants, stations, maintenance facilities, and new circuit breakers, it would result in emissions reductions from on-road vehicles and aircraft, relative to the 2015 Existing and 2029 and 2040 No Project conditions. Reductions in single-occupancy vehicles trips and aircraft activity achieve these emissions benefits; with a greater number of people traveling on the HSR system, fewer vehicle and aviation miles would occur. Because the reductions in on-road vehicles and aircraft activity are directly tied to ridership, there would be no difference in emissions benefits among the alternatives. It should be noted that the emission savings due to reduced VMT are conservative because they do not consider the recently enacted SAFE Vehicles Rule. The SAFE Vehicles Rule increases GHG emission rates for light duty gasoline-powered vehicles. As such, applying the SAFE Vehicles Rule would increase the benefits of the HSR VMT reductions by as much as 10 percent for CO_2 emissions in 2040 (CARB 2020b). Nevertheless, the GHG reductions achieved by changes in on-road vehicles and aircraft activity would more than offset the emissions increase from project operations (electricity, stations, maintenance facilities, and circuit breakers). Long-term operation of all project alternatives and the larger HSR system would, therefore, result in a net reduction in operational emissions from the 2015 Existing and 2029 and 2040 No Project conditions. These emissions benefits would begin accumulating after construction emissions are offset, which as noted above, would occur within 8 to 14 months of project operations.

As described in Section 3.3.4.5, Methods for Determining Significance under CEQA, for projects to have a less-than-significant impact under CEQA on an individual and cumulative basis, the project must comply with an approved Climate Change Action Plan and demonstrate that it would

not impede the state from meeting the statewide 2020 GHG emissions target. The HSR project is discussed in CARB's AB 32 Scoping Plan and 2017 Scoping Plan update as a key strategy to meet California's long-term air quality and climate objectives (CARB 2008). As indicated in Table 3.3-29, all project alternatives would result in a net reduction in GHG emissions relative to the 2015 Existing conditions, 2029 No Project conditions, and 2040 No Project conditions, taking into account emissions during project construction, helping to meet the state's GHG reduction goals. The project is committed to using 100 percent renewable energy for electricity and the HSR system would run on electricity (thus offsetting vehicle fossil fuel emissions); therefore, the project would also help the state meet its 2045 goal of carbon neutrality in EO B-55-18.

CEQA Conclusion

The impact would be less than significant under CEQA for all alternatives because project operations would result in net statewide reductions of GHG emissions as travel modes shift away from on-road vehicles and aircraft trips to the HSR, which would avoid significant impacts from GHGs on the environment. Additionally, the HSR project is discussed in CARB's AB 32 scoping plan and 2017 Scoping Plan Update and would help the state attain its long-term GHG reductions goals as identified in AB 32, SB 32, and EO B-55-18. Consequently, the project would not impede the state from meeting the statewide GHG emissions reductions targets. Therefore, CEQA does not require mitigation.

3.3.7 Mitigation Measures

Construction emissions of VOC and NO_X would exceed BAAQMD thresholds under all project alternatives. SJVAPCD's annual thresholds for NO_X, CO, and PM_{10} would be exceeded under all alternatives during project construction. Construction exceedances of adopted thresholds could impede implementation of applicable air quality plans. Accordingly, there would be a significant impact under CEQA associated with project construction in the BAAQMD and SJVAPCD.

Construction activities would not exceed applicable local air district health risk thresholds or criteria; however, they would exceed state and federal ambient air quality standards. Construction of all alternatives would lead to new violations of the PM_{10} and $PM_{2.5}$ CAAQS and NAAQS, as well as potentially contribute to existing PM_{10} and $PM_{2.5}$ violations through exceedances of the SIL. Alternatives 1, 2, and 4 would also violate the 1-hour NO_2 NAAQS and CAAQS.

Table 3.3-30 outlines mitigation measures that will be implemented to address impacts on air quality during project construction. As discussed above, there would be no significant impacts under CEQA associated with project operations; therefore, no mitigation measures are required for project operations.

Table 3.3-30 Summary of Required Mitigation for Project Construction by Alternative

Mitigation Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
AQ-MM#1: Implement Additional On-Site Emissions Controls to Reduce Fugitive Dust	X	X	X	X
AQ-MM#2: Construction Emissions Reductions – Requirements for use of Zero Emission (ZE) and/or Near Zero Emission (NZE) Vehicles and off-road equipment	X	X	X	X
AQ-MM#3: Offset Project Construction Emissions in the San Francisco Bay Area Air Basin	X	X	X	X
AQ-MM#4: Offset Project Construction Emissions in the San Joaquin Valley Air Basin	X	X	X	X

AQ-MM#1: Implement Additional On-Site Emissions Controls to Reduce Fugitive Dust

During construction, the Contractor shall employ the following measures to minimize and control fugitive dust emissions:

- Where feasible, install wind breaks (e.g., dust curtains, plastic tarps, solid fencing) on the average dominant windward side(s) of construction areas. For purposes of implementation, chain-link fencing with added landscape mesh fabric adequately qualifies as solid fencing.
- Post a publicly visible sign with the telephone number and person to contact at the Authority regarding dust complaints. This person shall respond and take corrective action within 48 hours. The phone number for the local air district shall also be visible to ensure compliance with applicable regulations.

AQ-MM#2: Construction Emissions Reductions – Requirements for use of Zero Emission (ZE) and/or Near Zero Emission (NZE) Vehicles and off-road equipment

This mitigation measure will reduce the impact of construction emissions from project-related on-road vehicles and off-road equipment.

The Authority and all project construction contractors shall require that a minimum of 25 percent, with a goal of 100 percent, of all light-duty on-road vehicles (e.g., passenger cars, light-duty trucks) associated with the project (e.g., on-site vehicles, contractor vehicles) use ZE or NZE technology.

The Authority and all project construction contractors shall have the goal that a minimum of 25 percent of all heavy-duty on-road vehicles (e.g., for hauling, material delivery and soil import/export) associated with the project use ZE or NZE technology.

The Authority and all project construction contractors shall have the goal that a minimum of 10 percent of off-road construction equipment use ZE or NZE vehicles.

If local or state regulations mandate a faster transition to using ZE and/or NZE vehicles at the time of construction, the more stringent regulations will be applied. For example, Executive Order (EO) N-79-20, issued by California Governor Newsom September 23, 2020, currently states the following:

- Light duty and passenger car sales be 100 percent ZE vehicles by 2035
- Full transition to ZE short haul/drayage trucks by 2035
- Full transition to ZE heavy-duty long-haul trucks, where feasible, by 2045
- Full transition to ZE off-road equipment by 2035, where feasible.

The project will have a goal of surpassing the requirements of these or other future regulations as a mitigation measure.

AQ-MM#3: Offset Project Construction Emissions in the San Francisco Bay Area Air Basin

Prior to issuance of construction contracts, the Authority will conduct an air quality analysis that evaluates the conditions that exist at that time. If the analysis determines that there will be exceedances of the VOC or NOx thresholds, even after the application of the mitigation in AQ-MM#2, the Authority will enter into an agreement with BAAQMD to reduce VOC and NO_X to the required levels by acquiring offsets. The required levels in the SFBAAB are as follows:

1. For emissions in excess of the General Conformity *de minimis* thresholds (NO_X): net zero.
2. For emissions not in excess of *de minimis* thresholds but above the BAAQMD's daily emission thresholds (VOC and NO_X): below the appropriate CEQA threshold levels.

The mitigation offset fee amount will be determined at the time of mitigation to fund one or more emissions reduction projects within the SFBAAB. The offset fee will be determined by the Authority and BAAQMD based on the type of projects that present appropriate emission reduction

opportunities. These funds may be spent to reduce either VOC or NO_X emissions ("O_3 precursors"). Documentation of payment will be provided to the Authority or its designated representative.

The agreement will include details regarding the annual calculation of required offsets the Authority must achieve, funds to be paid, administrative fee, and the timing of the emissions reductions projects. Acceptance of this fee by BAAQMD will serve as an acknowledgment and commitment by BAAQMD to: (1) implement an emissions reduction project(s) within a timeframe to be determined based on the type of project(s) selected after receipt of the mitigation fee designed to achieve the emission reduction objectives; and (2) provide documentation to the Authority or its designated representative describing the project(s) funded by the mitigation fee, including the amount of emissions reduced (tons per year) in the SFBAAB from the emissions reduction project(s). To qualify under this mitigation measure, the specific emissions reduction project(s) must result in emission reductions in the SFBAAB that are real, surplus, quantifiable, enforceable, and will not otherwise be achieved through compliance with existing regulatory requirements or any other legal requirement. Pursuant to 40 C.F.R. Section 93.163(a), the necessary reductions must be achieved (contracted and delivered) by the applicable year in question. Funding will need to be received by BAAQMD prior to contracting with participants and should allow enough time to receive and process applications to fund and implement off-site reduction projects prior to commencement of project activities being reduced. This will roughly equate to 1 year prior to the required mitigation; additional lead time may be necessary depending on the level of off-site emission reductions required for a specific year.

This mitigation measure will be effective in offsetting emissions generated during project construction through the funding of emission-reduction projects. It is BAAQMD's experience that emissions offsets are feasible mitigation that effectively achieves actual emission reductions (Kirk 2018).

The implementation of this mitigation measure would not be expected to affect air quality in the BAAQMD because purchasing emissions offsets will not result in any physical change to the environment, and therefore would not result in other secondary environmental impacts. In addition to VOC and NO_X, the implementation of emission-reduction projects could result in reductions of other criteria pollutants and/or GHGs. However, this would be a secondary effect of this mitigation measure and is not a required outcome to mitigate any impacts of the project.

AQ-MM#4: Offset Project Construction Emissions in the San Joaquin Valley Air Basin

On June 19, 2014, the SJVAPCD and the Authority entered an MOU that establishes the framework for fully mitigating to net-zero construction emissions of NOx, VOC, PM_{10}, and $PM_{2.5}$ from the entire HSR project within the SJVAB (Authority and SJVUAPCD 2014). Emissions generated by construction of the portion of the project within the SJVAB are subject to this MOU and, therefore, must be offset to net zero. Pursuant to the MOU, the Authority and the SJVAPCD will enter into a Voluntary Emissions Reduction Agreement (VERA) to cover the portion of the project approved and funded for construction within the SJVAB. The project-level VERA must be executed prior to commencement of construction and the mitigation fees and offsets delivered and achieved according to the requirements of the VERA and MOU.

This mitigation measure will be effective in offsetting emissions generated during construction of the project through the funding of emission-reduction projects. It is SJVAPCD's experience that implementation of a VERA is feasible mitigation that effectively achieves actual emission reductions. Based on the performance of current incentive programs and reasonably foreseeable future growth, the SJVAPCD has confirmed that enough emissions reduction credits will be available to offset emissions generated by the project for all years in excess of the SJVAPCD's thresholds and the General Conformity *de minimis* threshold (Authority and SJVUAPCD 2014).

The implementation of this mitigation measure would not be expected to affect air quality in the SJVAPCD because purchasing emissions offsets will not result in any physical change to the environment, and therefore would not result in other secondary environmental impacts. In addition to NO_X and PM_{10}, the implementation of emission-reduction projects could result in

reductions of other criteria pollutants, GHGs, or both. However, this would be a secondary effect of this mitigation measure and is not a required outcome to mitigate any impacts of the project.

3.3.8 Impact Summary for NEPA Comparison of Alternatives

As described in Section 3.1.6.4, the effects of project actions under NEPA are compared to the No Project condition when evaluating the impact of the project on the resource. The determination of effect was based on the context and intensity of the change that would be generated by construction and operations of the project. Table 3.3-31 compares the impacts of the project alternatives and is followed by a summary of the impacts.

Temporary construction activity for all four project alternatives would generate NO_X emissions in excess of the General Conformity *de minimis* thresholds in the SFBAAB and SJVAB. Many factors influence the extent and magnitude of activity that would be required for construction, including the number and type of existing structures to be demolished, the amount of imported and exported dirt required during grading, and the number of traction power substations constructed. The combination of these factors is similar among Alternatives 2 and 4 and Alternatives 1 and 3 in the SFBAAB. The construction approach in the SJVAB would the same among all four project alternatives and the extent of the NO_X exceedance in the SJVAB would be the same.

On-site project features (AQ-IAMF#2 through AQ-IAMF#5) will minimize NO_X emissions in the SFBAAB and SJVAB by requiring the cleanest reasonably available diesel equipment and control measures to limit criteria pollutant emissions from construction equipment, vehicles, and concrete batch plants. AQ-MM#1 identifies additional BMPs for reducing on-site fugitive dust emissions. AQ-MM#2 requires that a minimum of 25 percent of all light-duty on-road vehicles use ZE or NZE technology. The measure also includes ZE and NZE goals for heavy-duty on-road trucks and off-road equipment. An agreement (AQ-MM#3) and VERA (AQ-MM#4) will offset remaining NO_X emissions in excess of the General Conformity *de minimis* thresholds generated in the SFBAAB and SJVAB to net zero, respectively. The Authority and FRA have agreed to collaborate on the development of General Conformity Determination. As a part of this collaboration, the Authority has developed and provide to FRA a Draft General Conformity Determination and supporting information, as well as the Authority's proposed approach for achieving general conformity (refer to Volume 2, Appendix 3.3-B, Draft Federal General Conformity Determination).

Table 3.3-31 Comparison of Project Alternative Impacts for Air Quality and Greenhouse Gases

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Air Quality				
Impact AQ#1: Temporary Direct and Indirect Impacts on Air Quality within the SFBAAB	Temporary construction activity would generate NO_X emissions in excess of the General Conformity *de minimis* threshold. Maximum annual NO_X emissions of 106 tons would occur in 2024. Annual construction emissions peak in 2024 [1] due to concurrent construction of all four subsections within the SFBAAB, as well as construction of the Gilroy MOWF, San Jose Diridon Station, and Downtown Gilroy Station. Emissions of all other pollutants would be below the respective General Conformity *de minimis* thresholds.	Same as Alternative 1. Maximum annual NO_X emissions of 155 tons would occur in 2024, which is the year with the greatest amount of total construction activity in the SFBAAB.	Same as Alternative 1. Maximum annual NO_X emissions of 114 tons would occur in 2024, which is the year with the greatest amount of total construction activity in the SFBAAB.	Same as Alternative 1. Maximum annual NO_X emissions of 156 tons would occur in 2024, which is the year with the greatest amount of total construction activity in the SFBAAB.
Impact AQ#2: Temporary Direct and Indirect Impacts on Air Quality within the NCCAB	Temporary construction activity would generate criteria pollutants, but those emissions would not degrade air quality resources in the NCCAB because the RSA is considered attainment for all criteria pollutants and there are no federally regulated General Conformity *de minimis* thresholds.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact AQ#3: Temporary Direct and Indirect Impacts on Air Quality within the SJVAB	Temporary construction activity would generate NO_X emissions in excess of the General Conformity *de minimis* threshold, which could degrade air quality resources in the SJVAB. Maximum annual NO_X emissions of 56 tons would occur in 2024. Annual construction emissions peak in 2024 due to concurrent construction of the two subsections within the SJVAB, as well as construction of the Los Banos MOWS. Emissions of all other pollutants would be below the respective General Conformity *de minimis* thresholds.	Same as Alternative 1. Maximum annual NO_X emissions of 56 tons would occur in 2024, which is the year with the greatest amount of total construction activity in the SJVAB.	Same as Alternative 1. Maximum annual NO_X emissions of 56 tons would occur in 2024, which is the year with the greatest amount of total construction activity in the SJVAB.	Same as Alternative 1. Maximum annual NO_X emissions of 56 tons would occur in 2024, which is the year with the greatest amount of total construction activity in the SJVAB.
Impact AQ#4: Temporary Direct Impacts on Implementation of an Applicable Air Quality Plan	Emissions of NO_X from temporary construction activity in excess of the General Conformity *de minimis* thresholds could impede implementation of ozone plans in the SFBAAB and SJVAB.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact AQ#5: Temporary Direct Impacts on Localized Air Quality—Criteria Pollutants	Temporary construction activity would violate the 1-hour NO_2 CAAQS and NAAQS, annual PM_{10} CAAQS, annual $PM_{2.5}$ CAAQS and NAAQS, and 24-hour $PM_{2.5}$ NAAQS. Emissions concentrations would also exceed the 24-hour and annual PM_{10} SIL and 24-hour and annual $PM_{2.5}$ SIL.	Same as Alternative 1.	Temporary construction activity would violate the annual PM_{10} CAAQS, annual $PM_{2.5}$ CAAQS and NAAQS, and 24-hour $PM_{2.5}$ NAAQS. Emissions concentrations would also exceed the 24-hour and annual PM_{10} SIL and 24-hour and annual $PM_{2.5}$ SIL.	Temporary construction activity would violate the 1-hour NO_2 CAAQS and NAAQS, annual and 24-hour PM_{10} CAAQS, annual $PM_{2.5}$ CAAQS and NAAQS, and 24-hour $PM_{2.5}$ NAAQS. Emissions concentrations would also exceed the 24-hour and annual PM_{10} SIL and 24-hour and annual $PM_{2.5}$ SIL.

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact AQ#6: Temporary Direct Impacts on Localized Air Quality—Exposure to Diesel Particulate Matter and $PM_{2.5}$ (Health Risk)	Temporary construction activity would not generate DPM or $PM_{2.5}$ concentrations in excess of established health risk thresholds. The maximum increase in potential cancer risk (5.0 per million) would occur in the San Joaquin Valley Subsection.	Same as Alternative 1. The maximum increase in potential cancer risk (5.0 per million) would occur in the Monterey Corridor and San Joaquin Valley Subsection.	Same as Alternative 1. The maximum increase in potential cancer risk (9.4 per million) would occur in the Morgan Hill and Gilroy Subsection.	Same as Alternative 1 without the DDV. The maximum increase in potential cancer risk (6.1 per million) for Alternative 4 without the DDV would occur in the Monterey Corridor Subsection. For Alternative 4 with the DDV, the incremental cancer risk would be 8.4 per million.
Impact AQ#7: Temporary Direct Impacts on Localized Air Quality—Exposure to Asbestos, Lead-Based Paint, and Fungal Spores That Cause Valley Fever	Project design and compliance with existing asbestos and LBP handling and disposal standards, as well as fugitive dust control practices, would prevent exposure of sensitive receptors to substantial pollutant concentrations. There would be limited potential for exposure of sensitive receptors to asbestos or LBP associated with demolition of 4.3 million square feet. There would be limited potential for exposure of sensitive receptors to Valley fever associated with movement of 51.5 million cubic yards of soil and disturbance of 813 acres.	Same as Alternative 1. There would be limited potential for exposure of sensitive receptors to asbestos or LBP associated with demolition of 7.1 million square feet. There would be limited potential for exposure of sensitive receptors to Valley fever associated with movement of 60.4 million cubic yards of soil and disturbance of 1,047 acres.	Same as Alternative 1. There would be limited potential for exposure of sensitive receptors to asbestos or LBP associated with demolition of 4.0 million square feet. There would be limited potential for exposure of sensitive receptors to Valley fever associated with movement of 58.7 million cubic yards of soil and disturbance of 870 acres.	Same as Alternative 1. There would be limited potential for exposure of sensitive receptors to asbestos or LBP associated with demolition of 2.0 million square feet. There would be limited potential for exposure of sensitive receptors to Valley fever associated with movement of 52.2 million cubic yards of soil and disturbance of 1,048 acres.
Impact AQ#8: Temporary Direct Impacts on Localized Air Quality—Exposure to Odors	There would be limited potential for odors generated by construction to affect sensitive receptors or result in nuisance complaints.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact AQ#9: Continuous Permanent Direct Impacts on Air Quality within the SFBAAB, NCCAB, and SJVAB	Long-term operation of the HSR system would reduce regional criteria pollutant emissions, relative to No Project conditions, resulting in a regional and local air quality benefit. Annual reductions would range from 23 to 54 tons of VOC, 332 to 1,120 tons of CO, 208 to 447 tons of NO_X, 22 to 48 tons of SO_2, 25 to 69 tons of PM_{10}, and 11 to 26 tons of $PM_{2.5}$, depending on the ridership scenario.	Same as Alternative 1. Annual reductions would range from 23 to 54 tons of VOC, 332 to 1,120 tons of CO, 208 to 447 tons of NO_X, 22 to 48 tons of SO_2, 18 to 61 tons of PM_{10}, and 10 to 25 tons of $PM_{2.5}$, depending on the ridership scenario.	Same as Alternative 1. Annual reductions would range from 23 to 54 tons of VOC, 330 to 1,119 tons of CO, 208 to 447 tons of NO_X, 22 to 48 tons of SO_2, 23 to 66 tons of PM_{10}, and 10 to 26 tons of $PM_{2.5}$, depending on the ridership scenario.	Same as Alternative 1. Annual reductions would range from 23 to 54 tons of VOC, 332 to 1,120 tons of CO, 208 to 447 tons of NO_X, 22 to 48 tons of SO_2, 16 to 59 tons of PM_{10}, and 9 to 25 tons of $PM_{2.5}$, depending on the ridership scenario.
Impact AQ#10: Continuous Permanent Direct Impacts on Implementation of an Applicable Air Quality Plan	Emissions reductions from project operations would support implementation of air quality plans and attainment of regional air quality goals.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact AQ#11: Continuous Permanent Direct Impacts on Localized Air Quality—Carbon Monoxide Hot Spots (NAAQS Compliance)	Increased traffic would not result in localized CO hot spots or exceedances of the CO NAAQS or CAAQS.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact AQ#12: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Mobile Source Air Toxics	Operation of the HSR system would result in a regional MSAT reduction and benefit. Increased station traffic would have a low potential for meaningful localized MSAT impacts.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact AQ#13: Continuous Permanent Direct Impacts on Localized Air Quality—Particulate Matter Hot Spots (NAAQS Compliance)	The project is not considered to be a project of air quality concern, based on the descriptions as indicated in 40 C.F.R. Section 93.123(b)(1).	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact AQ#14: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Diesel Particulate Matter and $PM_{2.5}$ (Health Risk)	Emissions of DPM and $PM_{2.5}$ from relocated freight service and station and maintenance facility operation would not expose sensitive receptors to pollutant health risks in exceedance of BAAQMD's thresholds.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact AQ#15: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Odors	Emissions-generated odors would be limited and would not be expected to affect a substantial number of people.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Greenhouse Gases				
Impact AQ#16: Temporary Direct and Indirect Impacts on Global Climate Change—Greenhouse Gas Emissions	GHG emissions generated during temporary construction of 14,870 metric tons CO_2e per year would be offset by reductions achieved through project operations in 8 to 10 months (relative to 2029 No Project conditions).	GHG emissions generated during temporary construction of 18,635 metric tons CO_2e per year would be offset by reductions achieved through project operations in 9 to 13 months (relative to 2029 No Project conditions).	GHG emissions generated during temporary construction of 15,082 metric tons CO_2e per year would be offset by reductions achieved through project operations in 8 to 10 months (relative to 2029 No Project conditions).	GHG emissions generated during temporary construction of 20,043 metric tons CO_2e per year would be offset by reductions achieved through project operations in 10 to 14 months (relative to 2029 No Project conditions).

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact AQ#17: Continuous Permanent Direct and Indirect Impacts on Global Climate Change—Greenhouse Gas Emissions	Long-term operation of the HSR system would reduce GHG emissions, relative to No Project conditions, resulting in a statewide and regional GHG benefit. Annual reductions would range from 1.1 million metric tons CO_2e to 1.6 million metric tons CO_2e, depending on the ridership scenario.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.

[1] The analysis assumed that project construction would take place from 2018 to 2026. As construction is expected to take place later than these dates, the construction emissions estimates are conservative, as future emissions rates will be lower due to the implementation of cleaner and newer equipment.

BAAQMD = Bay Area Air Quality Management District
C.F.R. = Code of Federal Regulations
CAAQS = California ambient air quality standards
CO = carbon monoxide
CO_2e = carbon dioxide equivalent
DPM = diesel particulate matter
GHG = greenhouse gases
HSR = high-speed rail
LBP = lead-based paint
MOWS = maintenance of way siding
MOWF = maintenance of way facility
MSAT = mobile source air toxics
NAAQS = national ambient air quality standards
NCCAB = North Central Coast Air Basin
NO_2 = nitrogen dioxide
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
RSA = resource study area
SFBAAB = San Francisco Bay Area Air Basin
SIL = significant impact level
SJVAB = San Joaquin Valley Air Basin
SO_2 = sulfur dioxide
VOC = volatile organic compound

Temporary construction activity for all four project alternatives would result in emissions that are below the BAAQMD, MBARD, and SJVAPCD's significant cancer risk thresholds; 10 in one million for BAAQMD and MBARD and 20 in one million for SJVAPCD. In addition, the hazard index threshold of one for all three air districts would not be exceeded. However, construction of all four project alternatives would lead to new violations of the PM_{10} and $PM_{2.5}$ CAAQS and NAAQS, as well as potentially contribute to existing PM_{10} and $PM_{2.5}$ violations through exceedances of the SIL. Alternatives 1, 2, and 4 would also violate the 1-hour NO_2 NAAQS and CAAQS. On-site project features (AQ-IAMF#1 through AQ-IAMF#6) that require the cleanest reasonably available diesel equipment and control measures will reduce concentrations, but exceedances of the applicable NAAQS will still occur. AQ-MM#1 and AQ-MM#2 identify additional control strategies for reducing on-site emissions, including ZE or NZE requirements and goals for vehicles and off-road equipment. Emissions reductions achieved by AQ-MM#1 and AQ-MM#2 cannot currently be quantified or included in the analysis. In general, the extent of the impact (i.e., the magnitude of the exceedance above the standard) is greatest under Alternative 4 and lowest under Alternative 3, but concentrations would vary by location and construction activity.

Demolition activities during project construction could encounter asbestos and LBP. Alternative 2 requires the most demolition (7.1 million square feet), and therefore has the highest potential to encounter and expose receptors to impacts from asbestos and LBP. Alternative 1 requires the second most demolition (4.3 million square feet), followed by Alternative 3 (4.0 million square feet) and Alternative 4 (2.0 million square feet). However, project design and compliance with existing asbestos and LBP handling and disposal standards would prevent exposure of sensitive receptors to pollutant concentrations with respect to asbestos and LBP. Similarly, the potential for the project to expose receptors to increased risk of Valley fever will be addressed through fugitive dust controls (AQ-IAMF#1). Odors generated during construction are not expected to result in nuisance complaints.

During operations, none of the project alternatives would generate emissions in excess of the General Conformity *de minimis* thresholds, because all alternatives would reduce criteria pollutant emissions, resulting in a regional air quality benefit. Indirect emissions from electricity consumption to power the trains would be equal for all four project alternatives with and without the design variants. Emissions benefits from reduced on-road vehicle and aircraft activity would be equal for all four project alternatives. Direct emissions of wind-induced dust would be emitted from train movement, with Alternative 4 resulting in the highest dust emissions. Station operation would also generate criteria pollutant emissions from mobile (e.g., employee commute vehicles) and area (e.g., architectural coatings) sources. The East Gilroy Station, under Alternative 3, would emit slightly more emissions compared to the Downtown Gilroy Station under Alternatives 1, 2, and 4. Therefore, although Alternative 3 would result in a slightly lower reduction in criteria pollutants than the other project alternatives, the overall difference would not be meaningful in the context of the total emission reductions, and all four project alternatives would result in comparable air quality benefits. The project alternatives would not conflict with any air quality plans or obstruct attainment of any air quality standards during operations.

Increased station traffic would be similar among all four project alternatives and would not worsen traffic conditions to an extent that would result in localized CO or PM hot spots. Likewise, consistent with FHWA guidance, changes in local traffic conditions would have a low potential for meaningful MSAT impacts. Relocated freight service and station and maintenance facility operation would not generate DPM or $PM_{2.5}$ concentrations in excess of BAAQMD's cancer and noncancer risk thresholds. Odors generated during operations would be very limited and would not be expected to result in nuisance complaints.

Similar to criteria pollutants, construction of all four project alternatives would generate GHG emissions. Total amortized GHG construction emissions would range between 14,870 and 20,043 metric tons CO_2e per year, with Alternative 4 generating the most emissions, and Alternative 1 generating the least. Emissions reductions during long-term project operations would offset construction-related GHGs within 8 to 14 months (compared to 2029 operations). The overall change in GHG emissions would be approximately the same under all alternatives. As a result,

none of the project alternatives would result in net adverse global climate change impacts from GHG emissions. Rather, the reductions achieved by the project would be a GHG benefit.

3.3.9 CEQA Significance Conclusions

As described in Section 3.1.6.4, the impacts of project actions under CEQA are evaluated against thresholds to determine whether a project action would result in no impact, a less-than-significant impact, or a significant impact. Table 3.3-32 identifies the CEQA significance determinations for each impact discussed in Section 3.3.6. A summary of the significant impacts, mitigation measures, and factors supporting the significance conclusion after mitigation follows the table.

Table 3.3-32 CEQA Significance Conclusions and Mitigation Measures for Air Quality and Greenhouse Gases

CEQA Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measure	CEQA Level of Significance after Mitigation
Air Quality			
Impact AQ#1: Temporary Direct and Indirect Impacts on Air Quality within the SFBAAB	Significant for all alternatives. Construction-related VOC and NOX emissions would exceed BAAQMD's thresholds.	AQ-MM#1: Implement Additional On-Site Emissions Controls to Reduce Fugitive Dust AQ-MM#2: Construction Emissions Reductions – Requirements for use of Zero Emission (ZE) and/or Near Zero Emission (NZE) Vehicles and off-road equipment AQ-MM#3: Offset Project Construction Emissions in the SFBAAB	Less than Significant
Impact AQ#2: Temporary Direct and Indirect Impacts on Air Quality within the NCCAB	Less than significant for all alternatives. Construction-related PM_{10} emissions would not exceed MBARD's threshold.	No mitigation measures are required	N/A
Impact AQ#3: Temporary Direct and Indirect Impacts on Air Quality within the SJVAB	Significant for all alternatives. Construction-related NOX, CO, and PM10 emissions would exceed SJVAPCD's thresholds	AQ-MM#1: Implement Additional On-Site Emissions Controls to Reduce Fugitive Dust AQ-MM#2: Construction Emissions Reductions – Requirements for use of Zero Emission (ZE) and/or Near Zero Emission (NZE) Vehicles and off-road equipment AQ-MM#4: Offset Project Construction Emissions in the SJVAB	Less than Significant (NOX and PM10) Significant and Unavoidable (CO)

CEQA Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measure	CEQA Level of Significance after Mitigation
Impact AQ#4: Temporary Direct Impacts on Implementation of an Applicable Air Quality Plan	Significant for all alternatives. Project construction would generate emissions that could conflict with air quality attainment plans.	AQ-MM#1: Implement Additional On-Site Emissions Controls to Reduce Fugitive Dust AQ-MM#2: Construction Emissions Reductions – Requirements for use of Zero Emission (ZE) and/or Near Zero Emission (NZE) Vehicles and off-road equipment AQ-MM#3: Offset Project Construction Emissions in the SFBAAB AQ-MM#4: Offset Project Construction Emissions in the SJVAB	Less than Significant
Impact AQ#5: Temporary Direct Impacts on Localized Air Quality—Criteria Pollutants	Significant for all alternatives. Construction-related criteria pollutant concentrations would violate the NO2, PM2.5, and PM10 NAAQS and CAAQS. Construction would also contribute to existing violations of the PM10 and PM2.5 ambient air quality standards.	AQ-MM#1: Implement Additional On-Site Emissions Controls to Reduce Fugitive Dust AQ-MM#2: Construction Emissions Reductions – Requirements for use of Zero Emission (ZE) and/or Near Zero Emission (NZE) Vehicles and off-road equipment	Significant and Unavoidable[1]
Impact AQ#6: Temporary Direct Impacts on Localized Air Quality—Exposure to Diesel Particulate Matter and $PM_{2.5}$ (Health Risk)	Less than significant for all alternatives. Construction-related DPM and $PM_{2.5}$ concentrations would not exceed adopted air district health risk thresholds.	No mitigation measures are required	N/A
Impact AQ#7: Temporary Direct Impacts on Localized Air Quality—Exposure to Asbestos, Lead-Based Paint, and Fungal Spores That Cause Valley Fever	Less than significant for all alternatives. Project design and compliance with existing asbestos and LBP handling and disposal standards would prevent exposure of sensitive receptors to substantial pollutant concentrations. The project would implement fugitive dust controls to reduce risk of Valley fever.	No mitigation measures are required	N/A

CEQA Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measure	CEQA Level of Significance after Mitigation
Impact AQ#8: Temporary Direct Impacts on Localized Air Quality—Exposure to Odors	Less than significant for all alternatives. Odors generated during construction would not be expected to affect a substantial number of people or result in nuisance complaints.	No mitigation measures are required	N/A
Impact AQ#9: Continuous Permanent Direct Impacts on Air Quality within the SFBAAB, NCCAB, and SJVAB	Less than significant for all alternatives. Long-term operation of the HSR system would reduce criteria pollutant emissions relative to No Project conditions, resulting in a regional and local air quality benefit.	No mitigation measures are required	N/A
Impact AQ#10: Continuous Permanent Direct Impacts on Implementation of an Applicable Air Quality Plan	Less than significant for all alternatives. Emissions reductions from project operations would support implementation of air quality plans and attainment of regional air quality goals.	No mitigation measures are required	N/A
Impact AQ#11: Continuous Permanent Direct Impacts on Localized Air Quality—Carbon Monoxide Hot Spots (NAAQS Compliance)	Less than significant for all alternatives. Increased traffic would not result in localized CO hot spots or exceedances of the CO CAAQS or NAAQS.	No mitigation measures are required	N/A
Impact AQ#12: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Mobile Source Air Toxics	Less than significant for all alternatives. Operations of the HSR system would result in a regional MSAT reduction and benefit. Increased station traffic would have a low potential for meaningful localized MSAT impacts.	No mitigation measures are required	N/A
Impact AQ#13: Continuous Permanent Direct Impacts on Localized Air Quality—Particulate Matter Hot Spots (NAAQS Compliance)	Less than significant for all alternatives. Changes in on-road vehicle operation would not expose sensitive receptors to substantial pollutant concentrations of PM.	No mitigation measures are required	N/A

CEQA Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measure	CEQA Level of Significance after Mitigation
Impact AQ#14: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Diesel Particulate Matter and $PM_{2.5}$ (Health Risk)	Less than significant for all alternatives. Emissions of DPM and $PM_{2.5}$ from relocated freight service and station and maintenance facility operation would not expose sensitive receptors to substantial pollutant concentrations since health risks would not exceed thresholds.	No mitigation measures are required	N/A
Impact AQ#15: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Odors	Less than significant for all alternatives. Odors generated by project operations would not be expected to affect a substantial number of people or result in nuisance complaints.	No mitigation measures are required	N/A
Greenhouse Gases			
Impact AQ#16: Temporary Direct and Indirect Impacts on Global Climate Change—Greenhouse Gas Emissions	Less than significant for all alternatives. GHG emissions generated during temporary construction would be offset by reductions achieved through project operations in 8 to 14 months.	No mitigation measures are required	N/A
Impact AQ#17: Continuous Permanent Direct and Indirect Impacts on Global Climate Change—Greenhouse Gas Emissions	Less than significant for all alternatives. Long-term operation of the HSR system would reduce GHG emissions relative to No Project conditions, resulting in a statewide and regional GHG benefit.	No mitigation measures are required	N/A

[1] While AQ-MM#3 and AQ-MM#4 will offset VOC, NO_X, and PM emissions, as required, these offsets could occur regionally throughout the SFBAAB and SJVAPCD. Accordingly, the emission reductions achieved by these offsets may not contribute to enough localized reductions to avoid a project-level violation of the AAQS or SIL.

BAAQMD = Bay Area Air Quality Management District
CAAQS = California ambient air quality standards
CO = carbon monoxide
DPM = diesel particulate matter
GHG = greenhouse gases
HSR = high-speed rail
LBP = lead-based paint
MBARD = Monterey Bay Resources District
MSAT = mobile source air toxics
N/A = not applicable
NAAQS = national ambient air quality standards
NCCAB = North Central Coast Air Basin
NO_2 = nitrogen dioxide
NO_X = nitrogen oxides
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SFBAAB = San Francisco Bay Area Air Basin
SIL = significant impact level
SJVAB = San Joaquin Valley Air Basin
SJVAPCD = San Joaquin Valley Air Pollution Control District
VOC = volatile organic compound

3.3.9.1 Impact AQ#1: Temporary Direct and Indirect Impacts on Air Quality within the SFBAAB

All alternatives would have a significant impact on air quality under CEQA during project construction because regional VOC and NO_X emissions would exceed the BAAQMD's CEQA thresholds, as shown in Table 3.3-12. Impacts associated with fugitive dust emissions will be minimized through implementation of a dust control plan (AQ-IAMF#1) and BMPs at new concrete batch plants (AQ-IAMF#6). The contractor will use low-VOC paints to limit the emissions of VOCs, which contribute to O_3 formation (AQ-IAMF#2). Exhaust-related pollutants will be reduced through use of renewable diesel, Tier 4 off-road engines, and model year 2010 or newer on-road engines, as required by AQ-IAMF#3 through AQ-IAMF#5. These project features will minimize air quality impacts and associated public health consequences through application of best available on-site controls to reduce construction emissions; however, even with these measures, project construction will result in exceedances of BAAQMD's regional VOC and NOx thresholds.

The Authority would further implement mitigation measures to reduce and offset the impacts on air quality resources. Specifically, AQ-MM#1 identifies additional BMPs for reducing on-site fugitive dust emissions, consistent with BAAQMD (2017a) guidance. AQ-MM#2 requires that a minimum of 25 percent of all light-duty on-road vehicles use ZE or NZE technology. The measure also includes ZE and NZE goals for heavy-duty on-road trucks and off-road equipment. The commercial availability of future ZE and NZE off-road equipment and heavy-duty vehicles in the California market is uncertain but expected to improve given technological advancements and CARB regulations. Therefore, in addition to the minimum light-duty on-road vehicle ZE and NZE requirement of 25 percent, AQ-MM#2 includes ZE and NZE goals for off-road equipment and heavy-duty vehicles. ZE and NZE equipment and vehicles do not directly generate or generate only minimal criteria pollutants, and thus AQ-MM#2 will reduce the severity of this impact. However, because the penetration of ZE and NZE off-road equipment and heavy-duty vehicles in future construction fleets is unknown, emissions reductions achieved by this measure cannot currently be quantified.

The Authority would implement AQ-MM#3 to offset remaining VOC and NO_X emissions to below BAAQMD's CEQA thresholds. BAAQMD thresholds are based on emissions levels identified under the New Source Review (NSR) program (BAAQMD 2017a). The NSR program is a permitting program that was established by Congress as part of the CAA amendments to ensure that air quality is not significantly degraded by new sources of emissions. The NSR program requires that stationary sources receive permits before starting construction or use of the equipment. By permitting large stationary sources, the NSR program assures that new emissions would not slow regional progress toward attaining the NAAQS. Because BAAQMD's thresholds were established to prevent emissions from new projects in the SFBAAB from contributing to CAAQS or NAAQS violations, offsetting emissions below the threshold levels would avoid potential conflicts with the ambient air quality plans, and would ensure that project construction would not contribute a significant level of air pollution such that regional air quality within the SFBAAB would be degraded. Accordingly, with implementation of AQ-MM#1 through AQ-MM#3, the impact will be less than significant.

3.3.9.2 Impact AQ#3: Temporary Direct and Indirect Impacts on Air Quality within the SJVAB

All alternatives would have a significant impact under CEQA because construction would result in NO_X, CO, and PM_{10} emissions that would exceed the SJVAPCD's CEQA thresholds, as shown in Table 3.3-14. Implementation of a dust control plan (AQ-IAMF#1) and BMPs at new concrete batch plants (AQ-IAMF#6) will minimize impacts associated with fugitive dust emissions. The contractor will use low-VOC paints to limit the emissions of VOCs, which contribute to O_3 formation (AQ-IAMF#2). Exhaust-related pollutants will be reduced through use of renewable diesel, Tier 4 off-road engines, and model year 2010 or newer on-road engines, as required by AQ-IAMF#3 through AQ-IAMF#5. These project features will minimize air quality impacts and associated public health consequences through application of best available on-site controls to

reduce construction emissions. However, even with these measures, exceedances of air district thresholds will still occur.

The Authority would therefore implement mitigation to reduce and offset the impacts on air quality resources. Specifically, AQ-MM#1 identifies additional BMPs for reducing on-site fugitive dust emissions. AQ-MM#2 requires that a minimum of 25 percent of all light-duty on-road vehicles use ZE or NZE technology. The measure also includes ZE and NZE goals for heavy-duty on-road trucks and off-road equipment. The commercial availability of future ZE and NZE off-road equipment and heavy-duty vehicles in the California market is uncertain but expected to improve given technological advancements and regulations. Therefore, in addition to the minimum light-duty on-road vehicle ZE and NZE requirement of 25 percent, AQ-MM#2 includes ZE and NZE goals for off-road equipment and heavy-duty vehicles. ZE and NZE equipment and vehicles do not directly generate or generate only minimal criteria pollutants, and thus AQ-MM#2 will reduce the severity of this impact. However, because the penetration of ZE and NZE off-road equipment and heavy-duty vehicles in future construction fleets is unknown, emissions reductions achieved by this measure cannot currently be quantified.

The Authority would implement AQ-MM#4 to fully offset (i.e., to net zero) all remaining emissions of VOC, NOx, and PM within the SJVAPCD, pursuant to the Authority's MOU with the air district for the entire HSR project within the SJVAB. Offsetting VOC, NO_X, and PM_{10} emissions to net zero would avoid potential conflicts with the ambient air quality plans, and would ensure that project construction would not contribute a net increase in emissions or degraded regional air quality.

Pursuant to SJVAPCD's *Guidance for Assessing and Mitigating Air Quality Impacts* (SJVAPCD 2015a), emissions offsets procured through AQ-MM#4 could not be used to mitigate CO impacts. While CO has more direct and localized impacts than regional pollutants like VOC and NOx, SJVAPCD has adopted a threshold that considers basin-wide effects of CO emissions with respect to attainment of the ambient air quality standards. The ability of a region to attain and subsequently maintain the ambient air quality standards is based on cumulative emissions contributions for sources throughout the air basin. Translating project-generated CO emissions to the resultant number of basin-wide days of attainment or nonattainment cannot be estimated using available models with a high degree of accuracy. However, as discussed under Impact AQ#5, dispersion modeling conducted for the project demonstrates that construction-generated CO concentrations would not cause new localized violations of the CO CAAQS or NAAQS. While the project-level dispersion modeling indicates that project construction in the SJVAB would not lead to violations of the ambient air quality standards, because mass emissions would exceed SJVAPCD's threshold, this impact is conservatively concluded significant and unavoidable.

3.3.9.3 Impact AQ#5: Temporary Direct Impacts on Localized Air Quality—Criteria Pollutants

All alternatives would have a significant impact under CEQA because construction would lead to new violations of the PM_{10} and $PM_{2.5}$ CAAQS and NAAQS, as well as potentially contribute to existing PM_{10} and $PM_{2.5}$ violations through exceedances of the SIL. Alternatives 1, 2, and 4 would also violate the 1-hour NO_2 NAAQS and CAAQS. Project features will minimize air quality impacts (AQ-IAMF#1 through AQ-IAMF#6), although emissions concentrations will still violate the ambient air quality standards and exceed the SIL. These project features represent best available on-site controls to reduce construction emissions. AQ-MM#1 identifies additional BMPs for reducing on-site fugitive dust emissions. AQ-MM#2 requires that a minimum of 25 percent of all light-duty on-road vehicles use ZE or NZE technology. The measure also includes ZE and NZE goals for heavy-duty on-road trucks and off-road equipment. No additional mitigation is available.[22] Therefore, the impact would be significant and unavoidable.

[22] While AQ-MM#3 and AQ-MM#4 will offset VOC, NO_X, and PM emissions, as required, these offsets could occur regionally throughout the SFBAAB and SJVAPCD. Accordingly, the emission reductions achieved by these offsets may not contribute to enough localized reductions to avoid a project-level violation of the AAQS or SIL.

The NAAQS and CAAQS are set to protect public health and the environment within an adequate margin of safety. Some individuals exposed to pollutant concentrations that exceed the CAAQS or NAAQS may experience certain acute and/or chronic health conditions. Studies have linked particulate pollution to problems such as premature death in people with heart or lung disease, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, and increased respiratory symptoms (e.g., coughing) (USEPA 2019c). Studies have linked NO_2 pollution to the aggravation and/or development of certain respiratory diseases (e.g., asthma), leading to respiratory symptoms (e.g., coughing), hospital admissions, and visits to emergency rooms (USEPA 2019d).

There are no models capable of performing a project-specific correlation of project-generated NO_2 or PM emissions to specific health consequences (e.g., increase cases of asthmas). Models that quantify changes in ambient pollution and resultant health effects were developed to support regional planning and policy analysis and have limited sensitivity to small changes in criteria pollutant concentrations induced by individual projects. Accordingly, translating project-generated NO_2 or PM emissions to the locations where specific health effects could occur or the resultant number of additional days of nonattainment cannot be estimated with a high degree of accuracy.

While there is no available tool to individually model project-level NO_2 or PM health effects, USEPA (2018c) has developed an approach for estimating the average human health impacts related to emissions of direct $PM_{2.5}$ and $PM_{2.5}$ precursors (NOx and SO_2).[23] These benefit per ton metrics have been developed for 17 emission sectors (e.g., mobile sources) using nationwide photochemical modeling and demographic input parameters. All estimates are based on a national-scale study and do not account for location-specific meteorology, geographic distribution of receptors, or photochemistry, all of which can affect pollutant dispersion and exposure. The resultant health effects are therefore reflective of national averages and may not be exact when applied to the project-level. Nevertheless, the best practicable technology estimates can provide a general order-of-magnitude characterization of potential health consequences associated with project-generated direct PM and precursors to PM (with no secondary formation).

Table 3.3-33 presents the estimated incidence (i.e., cases) of health effects based on the construction inventory for Alternative 4. Alternative 4 would generate the most emissions of all project alternatives, and therefore represents the alternative with the greatest potential health burden. The estimates were developed by multiplying total project-generated $PM_{2.5}$ and $PM_{2.5}$ precursor (NOx and SO_2) emissions across all air districts (in average tons per year) by the relevant incidence per-ton metric from the USEPA (2018c).[24]

Table 3.3-33 Estimated Incidence of Health Endpoints Based on Total Directly Emitted NO_x, SO_x, and $PM_{2.5}$ Emissions during Construction of Alternative 4

Health endpoint	Incidence (cases per year)[1]
Premature mortality	2
Respiratory emergency room visits	<1
Acute bronchitis	1
Lower respiratory symptoms	17
Upper respiratory symptoms	25

[23] Conversion of NOx to NO_2 occurs in the atmosphere through various reactions. Due to the complex chemistry governing NO_2 and other pollution formation (e.g., ozone), USEPA was not able to derive best practicable technology values for secondary pollutants. USEPA's best practicable technology estimates are therefore only applicable to direct $PM_{2.5}$ and $PM_{2.5}$ precursors (NOx and SO_2) (with no secondary formation).

[24] Analysis does not include PM emissions from demolition and earthmoving activities as there are no applicable incidence per-ton metrics from the EPA for these sources. Demolition and earthmoving activities represent approximately 13 percent of total construction-generated $PM_{2.5}$ emissions.

Health endpoint	Incidence (cases per year)[1]
Minor restricted activity days	714
Work loss days	121
Asthma exacerbation	29
Cardiovascular hospital admissions	<1
Respiratory hospital admissions	<1
Non-fatal heart attacks (Peters)	<1
Non-fatal heart attacks (All others)	<1

Source: USEPA 2018c

[1] Calculated by multiplying total project-generated $PM_{2.5}$ and $PM_{2.5}$ precursor (NOx and SO_2) emissions across all air districts (in average tons per year) by the relevant incidence per-ton metric from the USEPA (2018c). USEPA's metrics are based on national data and do not account for any location-specific variables that may influence exposure to project-generated emissions. The results presented above are presented for informational purposes only. Because this is a scaled analysis based on national data, actual changes in health outcomes due to project emissions could be higher or lower than presented due to intervening effects of location of emissions, meteorology, and photochemistry.

< = less than

NO_X = nitrogen oxides

SO_2 = sulfur dioxide

$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter

USEPA = U.S. Environmental Protection Agency

As discussed above, caution should be exercised when reviewing these results as they are based on national averages and do not account for any location-specific variables that may influence exposure to project-generated emissions. This analysis is only presented for informational purposes and has no bearing on the impact determination, which is based on a comparison of emissions concentrations to the ambient air quality standards. It is also important to consider the magnitude of project-generated emissions and potential health risks relative to ambient conditions. Construction-generated $PM_{2.5}$ emissions in the SFBAAB, NCCAB, and SJVAB represent less than one percent of each air basins' respective $PM_{2.5}$ emissions inventories (CARB 2017; BAAQMD 2017b). The SFBAAB and SJVAB do not currently attain the $PM_{2.5}$ NAAQS or CAAQS. Certain individuals residing in areas that do not meet the CAAQS or NAAQS, or in locations adjacent to ambient sources of particulate pollution, could be exposed to PM concentrations that cause or aggravate acute and/or chronic health conditions (e.g., asthmas, lost work days, premature mortality), regardless of project construction.

3.4 Noise and Vibration

Since publication of the Draft Environmental Impact Report (EIR)/Environmental Impact Statement (EIS), the following substantive changes have been made to this section:

- A section was added to Section 3.4.2.1, Federal, regarding the Federal Railroad Administration (FRA) Procedures for Considering Environmental Impacts. Footnotes were added regarding FRA's Environmental Procedures and the updated Council on Environmental Quality (CEQ) regulations issued after release of the Draft EIR/EIS.
- A typographic error in the noise measurement data for noise measurement location N128 was corrected in Table 3.4-11 and Appendix 3.4-A, Noise and Vibration Technical Report (located in Volume 2, Technical Appendices).
- The text box in the introduction was updated to reflect revised impacts.
- Analysis about the Diridon design variant (DDV) and tunnel design variant (TDV), which was included in Section 3.20 in the Draft EIR/EIS, was incorporated into Appendix 3.4-A and Section 3.4. Figures 3.4-10b, 3.4-11b, 3.4-12b, 3.4-15b, 3.4-18b, 3.4-21b, 3.4-35b, 3.4-37b, 3.4-41b, and 3.4-44b were added to illustrate these effects, and Tables 3.4-16, 3.4-17, 3.4-28, 3.4-29, 3.4-30, 3.4-31, 3.4-32, 3.4-33, and 3.4-35 were updated to include effects of the DDV and TDV.
- As a result of public comments, revisions were made to the Alternative 4 noise impact assessment (including Impact NV#2) to correct errors in the analysis. This changed the number of noise impacts before mitigation and with mitigation in the San Jose Diridon Station Approach, Monterey Corridor, and the Morgan Hill and Gilroy Subsections. The mitigation measures have not changed. Changes were made to Figures 3.4-19, 3.4-20, 3.4-21a, 3.4-39, 3.4-40, 3.4-41a, 3.4-42, 3.4-43, and 3.4-44a; and Tables 3.4-16, 3.4-17, 3.4-26, 3.4-27, and 3.4-31.
- Additional noise-sensitive receptors were identified and determined to have noise impacts under all alternatives in the Pacheco Pass and San Joaquin Valley Subsections. Changes were made to Figures 3.4-11a, 3.4-11b, 3.4-12a, and 3.4-12b; and Tables 3.4-16, 3.4-17, 3.4-28, 3.4-29, 3.4-30, and 3.4-31.
- NV-MM#3 was modified to acknowledge that transparent materials would not be used in noise barriers in certain areas.
- NV-MM#4 was modified to include language that the California High-Speed Rail Authority (Authority) will assist with the preparation of technical analysis and provide input for Quiet Zone applications, which the local communities could then use as part of their application to the FRA.
- Sections 3.4.7, Mitigation Measures, 3.4.8, Impact Summary for NEPA Comparison of Alternatives, and 3.4.9, CEQA Significance Conclusions, were revised to include mitigation proposed in BIO-MM#80, which reduces the impacts at several locations in Pacheco Pass and San Joaquin Valley Subsections.
- Sections 3.4.7, Mitigation Measures, 3.4.8, Impact Summary for NEPA Comparison of Alternatives, and 3.4.9, CEQA Significance Conclusions, were revised to describe the potential effect of vibration mitigation (NV-MM#8) in reducing identified operational vibration impacts.
- Section 3.4.7.1, Noise Mitigation Analysis, was revised to add the potential mitigation effect of sound insulation for receptors that would still experience severe outdoor noise impacts after implementation of feasible noise barriers.
- A new appendix, Appendix 3.4-C, Noise Impact Locations (located in Volume 2), was added to provide more detailed figures showing potential impact locations and noise barriers.

- Impact NV#7, Table 3.4-33, and Section 3.4.8.2, Operations Noise, were revised to correct the screening distance from the high-speed rail (HSR) centerline for impacts on livestock at locations where HSR would sound warning horns. The text was updated for consistency with Table 3.4-19.
- Table 3.4-20 was corrected to show a moderate noise impact in Morgan Hill under Alternatives 1 and 3, and the total row value for moderate noise impacts under Alternative 4 was corrected to zero.
- Where appropriate, the verb "would," when used specifically to describe impact avoidance and minimization features (IAMFs) or mitigation measures, as well as their directly related activities, was changed to "will," indicating their integration into project design.

3.4.1 Introduction

This section describes the regulatory setting, affected environment, and potential impacts related to noise and vibration in the San Jose to Central Valley Wye Project Extent (project or project extent) resource study area (RSA). The potential impacts related to noise and vibration that would result from the construction and operation of the project alternatives are evaluated and presented in accordance with applicable guidelines. Mitigation measures that will reduce the identified impacts are also described.

Noise and vibration are key elements of the environmental impact assessment for an HSR project. Increases in noise and vibration are frequently cited as among the potential impacts of most concern to residents near an HSR alignment. Project noise and vibration impacts would consist of construction-related noise and vibration impacts and HSR operational noise and vibration impacts due to trains, train horns, stations and maintenance facilities, and station and maintenance facility–related vehicular traffic.

The differences between the four project alternatives is predominantly a result of the vertical and horizontal profile of each alternative, with most of those differences occurring in the San Jose Diridon Station Approach Subsection and the Morgan Hill and Gilroy Subsection. Alternative 4 would primarily be at-grade within the existing railroad right-of-way in these subsections, which would mean more train horn noise at the at-grade crossings in addition to train engine/wheel noise at-grade. As a result, Alternative 4 would have higher noise and vibration impacts prior to mitigation than the other alternatives. Alternatives 1 and 3 would predominantly be on aerial structure. Alternative 2 would have a longer embankment profile and elevation than Alternatives 1 and 3.

Primary Noise and Vibration Impacts

- Train operations, depending on alternative, would expose between 222 (Alt. 3) and 1,212 (Alt. 4) (233 [Alt. 3] and 1,224 [Alt. 4] with the design variants) sensitive receptors to severe noise impacts and between 834 (Alt. 3) and 1,844 (Alt. 2) (845 [Alt. 3] and 1,838 [Alt. 2] with the design variants) sensitive receptors to moderate noise impacts in 2040 without mitigation. With noise barrier mitigation, the number of sensitive receptors exposed to severe noise impact can be reduced to between 174 (Alt. 3) and 291 (Alt. 4) (185 [Alt. 3] and 303 [Alt. 4] with the design variants). With noise barrier mitigation and implementation of quiet zones by local jurisdictions, the number of sensitive receptors exposed to severe noise impacts will be reduced to between 174 (Alt. 3) and 224 (Alt. 1) (185 [Alt. 3] and 234 [Alt. 1] with the design variants).
- Significant traffic-related noise (greater than or equal to 3 dB increase) would occur in 2040 at 12 roadway segments near the San Jose Diridon Station, along Monterey Road, near the South Gilroy MOWF, and Downtown Gilroy Station.
- Train operations, depending on alternative, would generate between 81 (Alt. 1) and 1,203 (Alt. 4) vibration impacts, most of which would be in the Monterey Corridor.

The HSR project would result in the following changes to rail operations, all of which would affect noise and vibration conditions along the Caltrain corridor:

- Increase in the number of passenger trains—The HSR project would add an estimated 176 revenue trains per day to the Caltrain corridor (depending on location along the corridor). During the peak hour, up to 14 trains would be added.
- Change in passenger train technology—To operate a blended system efficiently, Caltrain operations would need to shift to 100 percent electric multiple unit (EMU) trains compared to only 75 percent EMUs with the Peninsula Corridor Electrification Project (PCEP). HSR would use 100 percent EMUs.
- Change in passenger train speeds—With track curve straightening, passenger service speeds would be up to 110 miles per hour (mph) for both Caltrain and HSR service with Alternative 4.
- New traction power facilities (TPF)—The project would build several new TPFs.

This analysis evaluates noise and vibration impacts associated with the four project alternatives for both the construction and operations.

Volume 2, Appendix 3.4-A, *San Jose to Merced Project Section Noise and Vibration Technical Report* (Noise and Vibration Technical Report) provides details to support this noise and vibration impact analysis. The following appendices in Volume 2 of this EIR/EIS also provide additional details on noise and vibration:

- Appendix 2-A, Roadway Crossings, Modifications, and Closures, describes road crossings of the alignment, road relocations, and road closures resulting from construction of the project.
- Appendix 2-B, Railroad Crossings, describes railroad crossings of the project alternatives.
- Appendix 2-D, Applicable Design Standards, describes the relevant design standards for this project.
- Appendix 2-E, Project Impact Avoidance and Minimization Features, provides the list of all IAMF incorporated into this project.
- Appendix 2-J, Regional and Local Plans and Policies, provides a list by resource of all applicable regional and local plans and policies.
- Appendix 3.4-A, Noise and Vibration Technical Report, presents the technical analysis to support this section.
- Appendix 3.4-B, Noise and Vibration Mitigation Guidelines, presents the Authority's noise and vibration mitigation guidelines.
- Appendix 3.4-C, Noise Impact Locations, presents detailed maps illustrating the 2040 Plus Project noise impact locations for each alternative.

The following Final EIR/EIS resource sections present additional information related to noise and vibration in other subject areas:

- Section 3.2, Transportation—Evaluates impacts on transportation resources, including roadway and rail traffic, that would lead to changes in noise and vibration in the RSA.
- Section 3.7, Biological and Aquatic Resources—Evaluates impacts of project construction and operations on wildlife that would be affected by noise and vibration.
- Section 3.9, Geology, Soils, Seismicity, and Paleontological Resources—Evaluates areas with sensitive surrounding land uses and soil that would be affected by vibration.
- Section 3.12, Socioeconomics and Communities—Evaluates sensitive communities and residential areas that would be affected by noise and vibration.
- Section 3.13, Land Use and Development—Evaluates locations where sensitive land uses and adjacent development would be affected by noise and vibration.
- Section 3.15, Parks, Recreation, and Open Space—Evaluates adjacent parks and recreation areas that would be affected by noise and vibration.

- Section 3.17, Cultural Resources—Evaluates historic architectural resources that would be affected by noise and vibration.

3.4.1.1 Definition of Terminology

The following are definitions for noise analyzed in this Final EIR/EIS.

Noise

Noise is discussed in terms of a "source-path-receptor" framework, as follows:

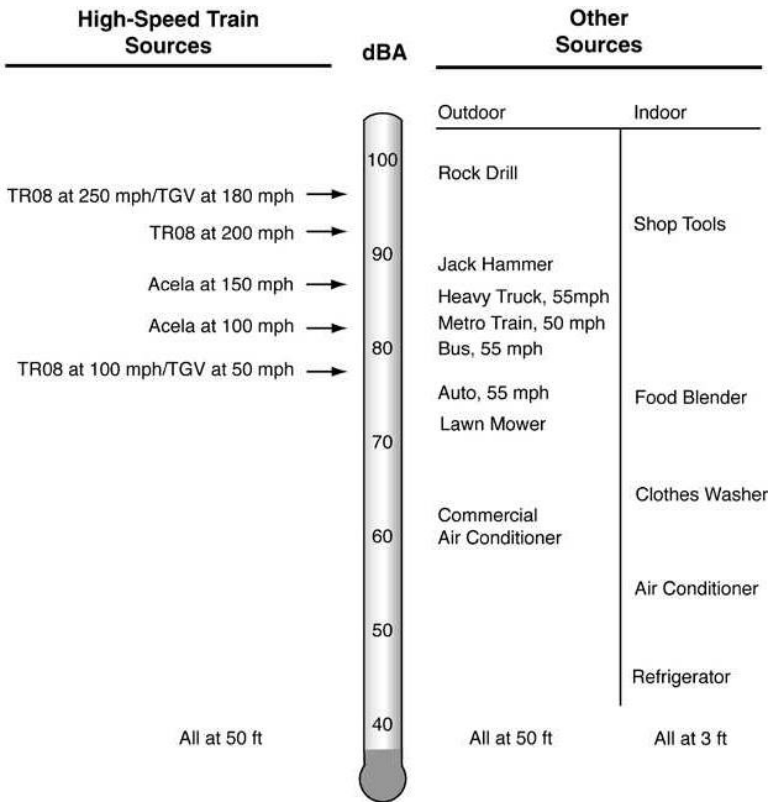
- Source—The *source* generates noise that depends on the type of source (e.g., an HSR train) and its operating characteristics (e.g., speed).
- Path—In between the source and the receptor is the *path*, where the noise is reduced by distance, intervening buildings and barriers or other features, and topography.
- Receptor—The *receptor* is the noise-sensitive land use (e.g., residence, hospital, or school, referred to as *sensitive receptors*) exposed to noise from the source.

Environmental noise impacts are assessed at the receptor. Noise criteria are established for the various types of receptors individually because not all receptors have the same noise sensitivity.

Analysts used three primary noise level descriptors (metrics) to assess noise impacts from traffic and transit projects:

- Equivalent sound level (L_{eq}) refers to a receptor's energy-averaged noise exposure from all events over a specified period (e.g., 1 minute, 1 hour, 24 hours).
- Day-night sound level (L_{dn}) refers to a receptor's energy-averaged noise exposure from all events over a 24-hour period with a penalty added for nighttime (10 p.m. to 7 a.m.) noise periods.
- Sound exposure level (SEL) refers to a receptor's noise exposure from a single noise event condensed into a 1-second duration.

The tonal character of noise is described by its frequency content. Individual frequencies or a range of frequencies are expressed in terms of the rate of fluctuation of the air pressure in cycles per seconds or Hertz (Hz). The average human ear and brain system can generally perceive noise frequencies between 20 Hz and 20,000 Hz. However, the human hearing system does not respond equally to all frequencies; it is more sensitive to mid-band frequencies (e.g., 500 to 2,000 Hz). Thus, when describing sound and its impacts on a human population, A-weighted decibel (dBA) sound pressure levels are used to account for the response of the human ear by de-emphasizing the low and very high frequency components of the sound. The A-weighted sound level correlates well with human response and is expressed in terms of a single number. Figure 3.4-1 illustrates typical A-weighted noise levels of HSR trains, as well as other indoor and outdoor noise sources. Typical A-weighted sound levels range from the 40s to the 90s (in dBA), where 40 is very quiet and 90 is very loud. On average, each A-weighted sound level increase of 10 decibels (dB) corresponds to an approximate doubling of subjective loudness.



Source: FRA 2012

FEBRUARY 2019

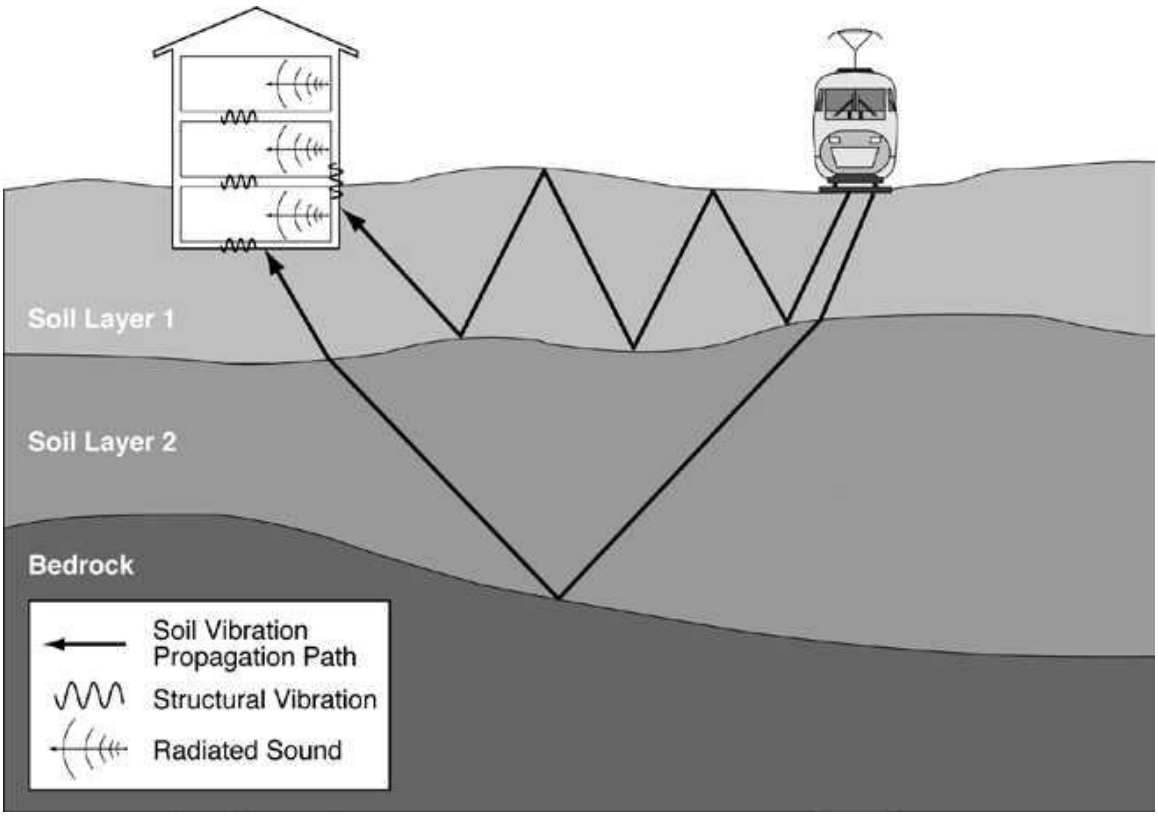
Figure 3.4-1 Typical A-Weighted Maximum Sound Levels

Vibration

Vibration is also discussed in terms of a "source-path-receptor" framework, as follows:

- Source—The *source* generates energy that causes vibration, such as the operation of construction equipment (e.g., pile driver) that could cause ground vibrations that spread through the ground and diminish in strength with distance from the source.
- Path—Once the vibration is in the ground, it propagates through the various soil and rock layers to the foundations of nearby buildings (the receptors). Ground-borne vibrations generally decline with distance, depending on the local geological conditions.
- Receptor—A *receptor* is a vibration-sensitive building (e.g., residence, hospital, or school), where the vibrations may cause perceptible shaking of the floors, walls, and ceilings, and a rumbling sound inside rooms. Not all receptors have the same vibration sensitivity. Consequently, criteria are established for the various types of receptors.

As with sound, vibration attenuates as a function of the distance between the source and the receptor. Vibration caused by trains moving along a transit structure, such as at-grade ballast and tie track, radiates energy into the adjacent soil. Buildings respond differently to ground vibration depending on the type of foundation, the mass of the building, and the building interaction with the soil. Once inside the building, vibration propagates throughout the building with some attenuation with distance from the foundation, but often with amplification from floor resonances. Figure 3.4-2 illustrates the basic concepts for rail system–generated ground vibration.



Source: FRA 2012 FEBRUARY 2019

Figure 3.4-2 Propagation of Ground-Borne Vibration into Buildings

Vibration can be described by its peak or root-mean-square (RMS) amplitudes. The RMS amplitude (expressed as vibration decibels, VdB) is useful for assessing human annoyance, while peak vibration is most often used for assessing the potential for damage to building structures. Building damage is often discussed in terms of peak velocity, or peak particle velocity (PPV). Construction vibration is assessed in terms of PPV. Volume 2, Appendix 3.4-A, provides additional details regarding noise and vibration descriptors.

Vibration is evaluated for its potential to cause damage to buildings, disrupt sensitive operations, or cause annoyance to humans in buildings. Although the threshold of human perception to vibration is approximately 65 VdB, annoyance does not usually occur until the vibration exceeds 70 VdB.

3.4.2 Laws, Regulations, and Orders

This section presents federal and state laws, regulations, and orders applicable to noise and vibration affected by the project. The Authority would implement the project in compliance with all federal and state regulations. Volume 2, Appendix 2-J, provides the regional and local plans and policies relevant to noise and vibration considered in the preparation of this analysis.

3.4.2.1 Federal

Federal Railroad Administration, Procedures for Considering Environmental Impacts (64 Fed. Reg. 28545)

On May 26, 1999, FRA released *Procedures for Considering Environmental Impacts* (FRA 1999). These FRA procedures supplement the Council on Environmental Quality Regulations (40 C.F.R. Part 1500 et seq.) and describe the FRA's process for assessing the environmental impacts of actions and legislation proposed by the agency and for the preparation of associated documents

(42 U.S. Code 4321 et seq.).[1,2] The FRA *Procedures for Considering Environmental Impacts* states that "the EIS should identify any significant changes likely to occur in the natural environment and in the developed environment. The EIS should also discuss the consideration given to design quality, art, and architecture in project planning and development as required by U.S. Department of Transportation Order 5610.4." These FRA procedures state that an EIS should consider possible impacts on noise and vibration.

Noise Control Act of 1972 (42 U.S.C. § 4910)

The Noise Control Act of 1972 (42 United States Code [U.S.C.] § 4910) was the first comprehensive statement of national noise policy. It declared, "it is the policy of the United States to promote an environment for all Americans free from noise that jeopardizes their health or welfare." Although the act, as a funded program, was ultimately abandoned at the federal level, it served as the catalyst for comprehensive noise studies and the generation of noise assessment and mitigation policies, regulations, ordinances, standards, and guidance for many states, counties and municipal governments. For example, the noise elements of community general plans and local noise ordinances studied as part of this analysis were largely created in response to passage of the act.

Occupational Safety and Health Administration Occupational Noise Exposure (29 C.F.R. § 1910.95)

The Occupational Safety and Health Administration (OSHA) (29 Code of Federal Regulations [C.F.R.] § 1910.95) has regulated worker noise exposure to a time-weighted-average of 90 dBA over an 8-hour work shift. Areas where levels exceed 85 dBA must be designated and labeled as high-noise-level areas where hearing protection is required. This noise exposure criterion for workers would apply to project construction activities. Noise from construction activities might also elevate noise levels at nearby construction sites to levels that exceed 85 dBA and thus trigger the need for administrative or engineering controls and hearing conservation programs for worker safety, as detailed by OSHA.

Federal Railroad Administration

Noise and Vibration Impact Assessment Guidelines

The FRA provides guidance regarding the evaluation of noise and vibration impacts from construction and operations of high-speed trains in *High-Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA guidance manual) (FRA 2012). The manual includes prediction methods, assessment procedures, and impact criteria for noise and vibration. Section 3.4.4.3, Methods for Impact Analysis, discusses noise and vibration impact criteria.

Railroad Noise Emission Compliance Regulations (49 C.F.R. Part 210)

FRA's Railroad Noise Emission Compliance Regulation (49 C.F.R. Part 210) prescribes minimum compliance regulations for enforcement of Noise Emission Standards for Transportation Equipment; Interstate Rail Carriers (40 C.F.R. Part 201) adopted by the U.S. Environmental Protection Agency (USEPA). New locomotives must meet the following noise standards: 70 dBA at 100 feet while stationary at idle throttle setting, 87 dBA at 100 feet while stationary at all other throttle settings, and 90 dBA at 100 feet while moving. Rail cars must meet the following noise standards: 88 dBA while moving at speeds of 45 mph or less, and 93 dBA at 100 feet while moving at speeds faster than 45 mph.

---

[1] While this EIR/EIS was being prepared, FRA adopted new NEPA compliance regulations (23 C.F.R. 771). Those regulations only apply to actions initiated after November 28, 2018. See 23 C.F.R. 771.109(a)(4). Because this EIR/EIS was initiated prior to that date, it remains subject to FRA's Environmental Procedures rather than the Part 771 regulations.

[2] The Council on Environmental Quality issued new regulations on July 14, 2020, effective September 14, 2020, updating the NEPA implementing procedures at 40 C.F.R. Parts 1500-1508. However, this project initiated NEPA before the effective date and is not subject to the new regulations, relying on the 1978 regulations as they existed prior to September 14, 2020. All subsequent citations to Council on Environmental Quality regulations in this environmental document refer to the 1978 regulations, pursuant to 40 C.F.R. 1506.13 (2020) and the preamble at 85 Fed. Reg. 43340.

Whether or not the USEPA standard applies to high-speed trainsets, the analysis in this EIR/EIS does not assume that Authority trainsets would comply with it because the Authority is not aware of any high-speed trainsets manufactured in the world today that meet this standard at all speeds. A noise-generation standard specific to high-speed trains does exist in Europe (European TSI Standard), and a trainset manufactured to that standard complies with the USEPA standard (if applicable) generally at speeds below 190 to 200 mph. Above 200 mph, airflow over the trainset and its pantograph and related apparatus is the main source of noise, which presently known technology cannot resolve to comply with the USEPA standard (if applicable). The analysis in this EIR/EIS—both prior to mitigation and after mitigation—assumes a trainset generating noise in compliance with the European TSI standard. Because trainsets currently in manufacture and operation in Europe can meet this standard; the analysis does not assume a trainset that meets the USEPA standard. In this project section the maximum HSR speeds would be 220 mph.

Locomotive Horn Rule (49 C.F.R. Part 222 & Part 229)

FRA regulations require that engineers sound their locomotive horns while approaching public grade crossings until the lead locomotive fully occupies the crossing. In general, the regulations require locomotive engineers to begin to sound the train horn for a minimum of 15 seconds, and a maximum of 20 seconds, in advance of public grade crossings. Engineers must also sound the train horn in a standardized pattern of two long, one short and one long blast and the horn must continue to sound until the lead locomotive or train car occupies the grade crossing. Additionally, the minimum sound level for the locomotive horn is 96 dB(A), while the maximum sound level is 110 dB(A), both measured at 100 feet forward of the locomotive. FRA allows public authorities to establish a quiet zone, which is segment of a rail line, within which is situated one or a number of consecutive public road-rail crossings at which locomotive horns are not routinely sounded, provided sufficient safety measures are implemented at the crossing to prevent/minimize the potential for accidents to occur. Railroad authorities, including Caltrain, CHSRA and railroad companies (such as UPRR) cannot establish quiet zones; only local cities and counties can establish them by applying to the FRA.

At a minimum, new quiet zones must be at least one-half mile in length and contain at least one public grade crossing (i.e., a location where a public highway, road, or street crosses one or more railroad tracks at grade). Every public grade crossing in a quiet zone must be equipped at a minimum with active grade crossing warning devices consisting of flashing lights and gates.

If a public authority wants to establish a new quiet zone, it must conduct an assessment of hazards related to the crossings in the proposed zone and implement sufficient safety measures to reduce the proposed quiet zone's risk level to an acceptable level. Improvements may include: Roadway medians or channelization devices to discourage motorists from driving around a lowered crossing gate; a four-quadrant gate system to block all lanes of highway traffic; converting a two-way street into a one-way street and installing crossing gates, and permanent or temporary (nighttime) closure of the crossing to highway traffic. As an alternative, communities may also choose to silence routine locomotive horn sounding through the installation of wayside horns at public grade crossings. Wayside horns are train-activated stationary acoustic devices at grade crossings that are directed at highway traffic as a one-for-one substitute for train horns.

As described in Chapter 2, Alternatives, the project includes the following improvements in all blended service segments with at-grade crossings: fencing of the right of way; four-quadrant gates and roadway channelization at at-grade crossings, and intrusion detection and monitoring systems. The installation of these features will assist local cities and counties to establish quiet zones should they decide to do so but cities or counties will need to go through the quiet zone process with the FRA first to establish such zones.

Federal Transit Administration Guidelines

The Federal Transit Administration (FTA) provides guidance regarding the evaluation of noise and vibration impacts associated with construction and operations of non-high-speed trains in *Transit Noise and Vibration Impact Assessment Manual* (FTA guidance manual) (FTA 2018). The manual includes prediction methods, assessment procedures, and impact criteria for noise and

vibration. Although it was originally developed for use on public mass transit projects, the FTA guidance manual includes a method that is applicable to HSR station activities, yard and maintenance facility activities, and conventional-speed rail operations. The FTA construction noise and vibration assessment methods are consistent with the FRA method. Section 3.4.4.3, Methods for Impact Analysis, discusses the noise and vibration impact criteria.

Federal Highway Administration Procedures for Abatement of Highway Traffic Noise and Construction Noise (23 C.F.R. Part 772)

The Federal Highway Administration (FHWA) stipulates procedures and criteria for noise assessment studies of highway projects (23 C.F.R. Part 772). It requires that noise abatement measures be considered on all major highway projects if the project will cause a substantial increase in traffic noise levels or if projected traffic noise levels approach or exceed the noise abatement criteria level for activities occurring on adjacent lands. These noise criteria are assigned to exterior and interior activities.

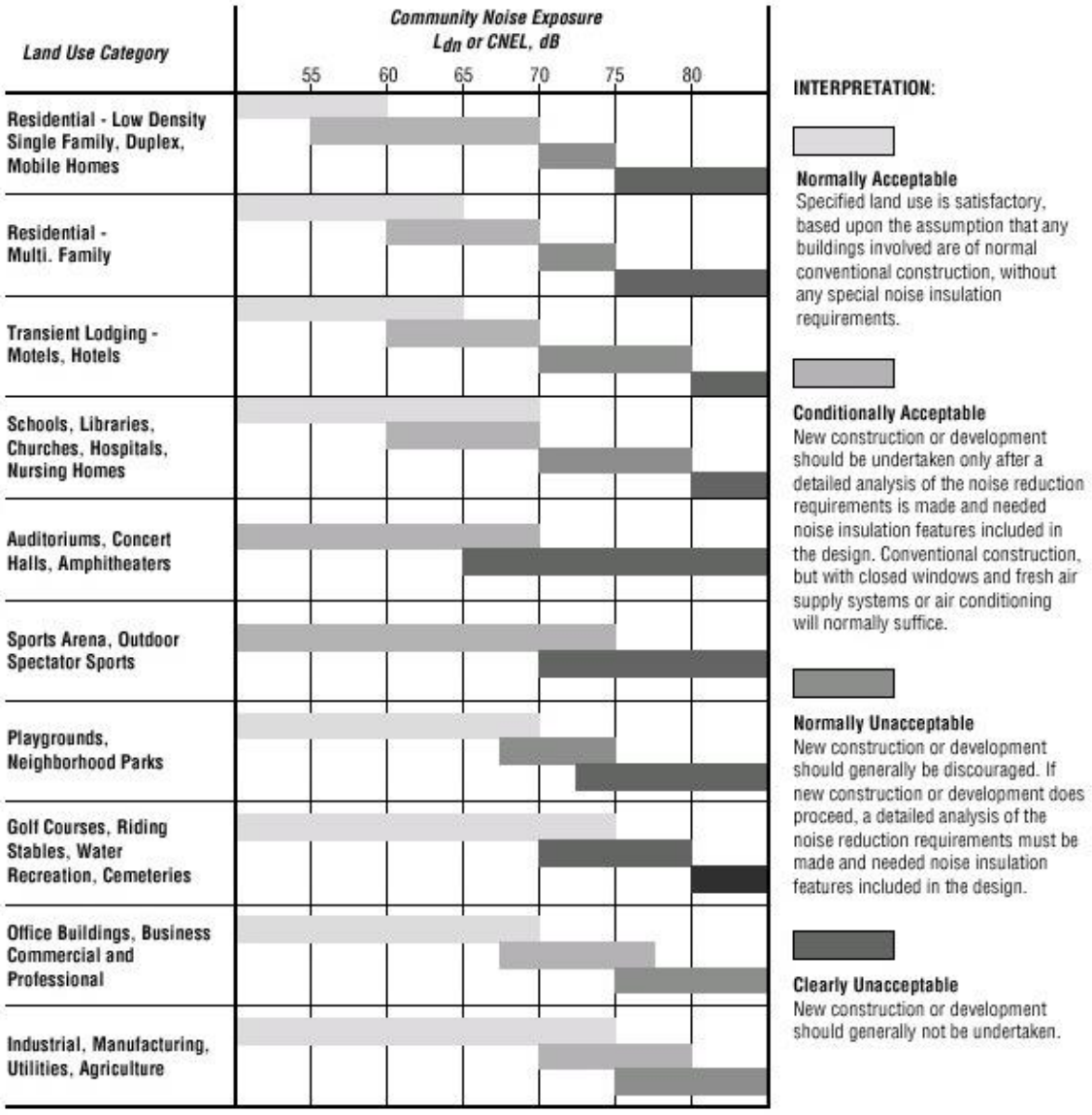
If motor vehicle traffic noise from federally funded projects is predicted to approach or exceed the noise abatement criteria during the noisiest 1-hour period, noise abatement measures must be considered, and, if determined to be reasonable and feasible, they must be incorporated as part of the project. Consistent with FHWA guidelines, the California Department of Transportation (Caltrans) defines “approach” as being within 1 dBA of the noise abatement criteria. Caltrans criteria also consider that a 12 dB increase in the noisiest 1-hour period is a significant increase as defined by the FHWA procedures.

3.4.2.2 State

General Plan Guidelines (Cal. Gov. Code § 65302(f)), Appendix C, Noise Element Guidelines

The noise element of a community’s general plan provides a basis for a comprehensive local program to control and abate environmental noise and to protect citizens from excessive exposure. The California Governor’s Office of Planning and Research (OPR) *General Plan Guidelines 2017* (OPR 2017) outlines the development of the noise element for local agencies.

Figure 3.4-3 (OPR 2017) is often adopted by city and county agencies for land use planning purposes for acoustical compatibility based on existing ambient noise levels in the community. For example, commercial land uses are considered appropriate where existing noise levels might be considered too high for residential development.


Land Use Category
Community Noise Exposure
Ldn or CNEL, dB
55
60
65
70
75
80
Residential - Low Density Single Family, Duplex, Mobile Homes
Residential - Multi. Family
Transient Lodging - Motels, Hotels
Schools, Libraries, Churches, Hospitals, Nursing Homes
Auditoriums, Concert Halls, Amphitheaters
Sports Arena, Outdoor Spectator Sports
Playgrounds, Neighborhood Parks
Golf Courses, Riding Stables, Water Recreation, Cemeteries
Office Buildings, Business Commercial and Professional
Industrial, Manufacturing, Utilities, Agriculture
INTERPRETATION:
Normally Acceptable
Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
Conditionally Acceptable
New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.
Normally Unacceptable
New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.
Clearly Unacceptable
New construction or development should generally not be undertaken.

Source: OPR 2017

Figure 3.4-3 State of California Land Use Compatibility Guidelines

California Department of Transportation Traffic Noise Analysis Protocol

The Caltrans *Traffic Noise Analysis Protocol* (Caltrans 2011) establishes guidelines for evaluating traffic noise impacts along highways where frequent outdoor use areas are located and for determining reasonable and feasible noise abatement measures. These criteria are relevant to the extent that the project could result in reconstruction or reconfiguration of an existing highway or traffic lanes, or could affect traffic patterns. Under FHWA and Caltrans policies, noise abatement should be considered for transportation improvement projects when various traffic noise abatement criteria are exceeded.

California Noise Control Act (Cal. Health and Safety Code § 46010 et seq.)

The relevant legacy of the California Noise Control Act of 1973 (California [Cal.] Health and Safety Code, Division 28, Noise Control Act, § 46000 et seq.) was the development of the

required content of the Noise Element of General Plans. This legislation provides guidance to local governments for preparing the required noise elements in city and county general plans, pursuant to California Government Code, Section 65302(f).

3.4.2.3 Regional and Local

Counties and cities in California prepare general plans with noise policies and ordinances according to guidelines outlined in the discussion of state regulations. In preparing the noise element, a city or county must identify local noise sources, and analyze and quantify, to the extent practicable, current and projected noise levels for various sources. These noise sources may include highways and freeways; passenger and freight railroad operations; ground rapid transit systems; commercial, general, and military aviation and airport operation; and other ground stationary noise sources, which would include HSR alignments. Noise-level contours must be mapped for these sources using the community noise equivalent level (CNEL) or the L_{dn}, and are to be used as a guide in land use decisions to minimize the exposure of community residents to excessive noise. General plans may but usually do not address ground-borne vibration.

Volume 2, Appendix 2-J, lists the regional and local policies applicable to the project. The HSR system is not subject to local general plan policies and ordinances related to noise limits or to locally based criteria concerning noise and vibration for the project alternatives.

3.4.3 Consistency with Plans and Laws

As indicated in Section 3.1.6.3, Consistency with Plans and Laws, the California Environmental Quality Act (CEQA) and CEQ regulations require a discussion of inconsistencies or conflicts between a proposed undertaking and federal, state, regional, or local plans and laws. As such, this Final EIR/EIS describes inconsistency of the project with federal, state, regional, and local plans and laws to provide planning context.

A number of federal and state laws and implementing regulations, listed in Section 3.4.2.1, Federal, and Section 3.4.2.2, State, govern compliance with noise emission limits for construction projects and for transportation facilities. As noise and vibration assessment is highly technical, there are several published federal and state guidance documents detailing how to assess potential impacts. Consistent with the guidance, a summary of the federal and state requirements considered in this analysis follows:

- FHWA and FRA guidelines for emissions of noise from transportation sources and for the abatement of excessive noise emissions.
- OSHA regulations that provide permissible construction worker noise exposure limits.
- FTA guidelines regarding modeling noise impacts from station activities, yard and maintenance facility activities, and conventional-speed rail operations.
- The Caltrans *Traffic Noise Analysis Protocol* (Caltrans 2011), which provides a methodology for evaluating noise from roadway operations and for evaluating the effectiveness and feasibility of different sound abatement methods for operations of highway-related projects.
- FRA guidelines regarding modeling and mitigating noise and vibration from construction sources at sensitive receptors close to construction. Since FRA provides guidance for analysis, the construction analysis methods discussed in the FHWA and FTA guidelines and the Caltrans protocol were not used; however, some construction equipment reference sound levels from FHWA were used.

The Authority, as the lead agency proposing to build and operate the HSR system, is required to comply with all federal and state laws and regulations and to secure all applicable federal and state permits prior to initiating construction on the selected alternative. Therefore, there would be no inconsistencies among the project alternatives and these federal and state laws and regulations.

The Authority is a state agency and, therefore, is not required to comply with local land use and zoning regulations; however, it has endeavored to design and build the HSR system to be

consistent with land use and zoning regulations. For example, the project alternatives incorporate IAMFs that will require the contractor to prepare a plan to demonstrate how construction noise levels will be maintained below applicable standards. The Authority has also adopted statewide policies that seek to reduce noise impacts associated with new sources of transportation noise (Volume 2, Appendix 3.4-B).

CEQA and CEQ regulations require the discussion of inconsistencies or conflicts between a proposed undertaking and regional or local plans and laws. Analysts reviewed 18 local plans and ordinances and 89 policies, guidelines, or goals, and determined the project alternatives would be consistent with all plans, policies, and ordinances reviewed with the exceptions noted below. Local limits are generally not placed on noise and vibration from transportation corridors; however, in some local codes there are noise limits imposed on construction noise and stationary facilities that are consistent with the applicable evaluation thresholds used in this analysis. Local land use planning guidance generally aims to develop noise-sensitive uses away from noise-intensive sources; the project evaluation thresholds also address impacts at noise-sensitive land uses.

A brief description of these inconsistencies follows:

- **Operational noise exceedances**—Although mitigation measures will reduce the project's operational noise impacts, noise impacts will not be reduced to the standards for residential, commercial, and institutional land uses established by the following general plan policies: *Envision: San José 2040 General Plan* (City of San Jose 2018), Land Use Compatibility Guidelines for Community Noise in San Jose, Table 4.
- **Codes of ordinances or zoning regulations from the City of San Jose**—Project construction would occur within a constrained operating rail corridor, and as such some trackwork and roadway work would be done at night to avoid disruption to Caltrain commuter rail operations and roadway operations. Even with the project features and mitigation measures, there will be locations where it is not technically feasible to meet the noise limits and permitted construction hours established by these local jurisdictions.

3.4.4 Methods for Evaluating Impacts

The evaluation of impacts from noise and vibration is a requirement of the National Environmental Policy Act (NEPA) and CEQA. The following sections summarize the RSAs and the methods used to analyze noise and vibration. As summarized in Section 3.4.1, Introduction, other resource sections in this Final EIR/EIS also provide additional information related to noise and vibration.

3.4.4.1 Definition of Resource Study Area

RSAs are the geographic boundaries in which the environmental investigations specific to each resource topic were conducted. The RSAs for impacts from noise and vibration encompass the areas directly or indirectly affected by project construction and operations. Table 3.4-1 shows the separate RSAs defined for noise and vibration.

Table 3.4-1 Definition of Noise and Vibration Resource Study Areas

Type	Boundary Definition
Noise	
Construction and operations	The noise RSA extends approximately 2,500 feet from the project alternatives' centerlines and includes all sensitive receptors potentially exposed to noise impacts.
Vibration	
Construction and operations	The vibration RSA extends 275 feet from the project alternatives' centerlines and includes all sensitive receptors potentially exposed to vibration impacts.

RSA = resource study area

The noise RSA extends approximately 2,500 feet from the project alternatives' centerlines and includes all sensitive receptors potentially exposed to noise impacts. This noise RSA is larger than the maximum FRA-recommended screening distances for HSR trains shown in Table 3.4-2. The maximum FRA-recommended screening distance for a new HSR corridor is 1,300 feet in quiet suburban/rural environments with trains operational speeds greater than 170 mph; however, this assumes that there would be 50 train operations per day. Consistent with FRA methods, analysts extended the noise RSA for the project beyond the maximum FRA-recommended screening distances to reflect the frequency of train operations, which would exceed 200 trains per day based on the Authority's *Connecting and Transforming California, 2016 Business Plan* (2016 Business Plan) (Authority 2016) and its *Connecting California, Expanding Economy, Transforming Travel, 2018 Business Plan (Final)* (2018 Business Plan) (Authority 2018).

Table 3.4-2 Federal Railroad Administration Recommended Screening Distances for Evaluation of High-Speed Rail Noise Impacts[1]

Corridor Type	Existing Noise Environment	Screening Distance for Project Type and Speed Regime (feet from centerline)[2]	
		90 to 170 miles per hour	> 170 miles per hour
Railroad	Urban/noisy suburban—unobstructed	300	700
	Urban/noisy suburban—intervening buildings[3]	200	300
	Quiet suburban/rural	500	1,200
Highway	Urban/noisy suburban—unobstructed	250	600
	Urban/noisy suburban—intervening buildings[3]	200	350
	Quiet suburban/rural	400	1,100
New Rail	Urban/noisy suburban—unobstructed	350	700
	Urban/noisy suburban—intervening buildings[3]	250	350
	Quiet suburban/rural	600	1,300[4]

Source: FRA 2012

[1] Noise screening distances for Regime II (mechanical noise resulting from wheel/rail interactions and guideway vibrations) and Regime III (aerodynamic noise resulting from airflow moving past the train).

[2] Measured from centerline of guideway or rail corridor. Minimum distance is assumed 50 feet.

[3] Rows of buildings are assumed to be at 200 feet, 400 feet, 600 feet, 800 feet, and 1,000 feet parallel to the guideway.

[4] Distance was extended to 2,500 feet for analysis of the project. See discussion in text.

The project's vibration RSA extends 275 feet from the project alternatives' centerlines. This distance is consistent with FRA screening procedures and was established to identify where vibration impacts from HSR might occur. Table 3.4-3 shows the FRA-recommended screening distances for vibration assessments of various land uses. To include all potentially affected areas along the project, analysts used the highest speed and frequent event categories to establish screening distances. Typically, noise-sensitive land uses are also vibration-sensitive; hence, the analyses are closely linked and where the noise and vibration RSAs overlap, the same locations were assessed for impacts from both noise and vibration.

Table 3.4-3 Federal Railroad Administration Recommended Screening Distances for Vibration Assessments

Land Use	Train Frequency[1]	Screening Distance (feet from centerline) Train Speed	
		100 to 200 miles per hour	200 to 300 miles per hour
Residential	Frequent	220	275
	Infrequent	100	140
Institutional	Frequent	160	220
	Infrequent	70	100

Source: FRA 2012

[1] Frequent = more than 70 passbys per day; Infrequent = fewer than 70 passbys per day

The same RSAs apply to direct and indirect impacts. Direct impacts consist of increases in noise and vibration as a result of project construction or operations, while indirect impacts for noise include the project's impact on traffic patterns, which indirectly affect noise levels.

3.4.4.2 Impact Avoidance and Minimization Features

IAMFs are project features that are considered to be part of the project. They are included as applicable in each of the project alternatives for purposes of the environmental impact analysis. Appendix 2-E provides the full text of the IAMFs that are applicable to the project. NV-IAMF#1: Noise and Vibration, is applicable to the construction-phase noise and vibration analysis. This environmental impact analysis considers this IAMF as part of the project design. Within Section 3.4.6, Environmental Consequences, each impact narrative describes how this project feature is applicable and, where appropriate, effective at avoiding or minimizing potential impacts to less than significant under CEQA.

3.4.4.3 Methods for Impact Analysis

This section describes the sources and methods the Authority used to analyze potential project impacts from noise and vibration. These methods apply to both NEPA and CEQA analyses unless otherwise indicated. Section 3.1.6.4 describes the general framework for evaluating impacts under NEPA and CEQA.

This section describes the approach to establishing the existing noise and vibration conditions, identifies applicable criteria used for HSR construction and operations noise and vibration thresholds, and summarizes the process for predicting construction and operations noise and vibration levels. The noise and vibration predictions for the project alternatives were based on the "Detailed Analysis" method described in the FRA guidance manual (FRA 2012) and, where applicable, the FTA guidance manual (FTA 2018), for station activities, yard and maintenance facility activities, and conventional-speed rail operations. Operational parameters that affect the noise and vibration analyses are summarized later in this section.

Analysts evaluated the following scenarios:

- **Existing conditions**—Reflects current noise and vibration conditions based on noise measurements and calibrated noise modeling of typical community activity.
- **Construction conditions**—Reflects noise and vibration impacts expected from project construction.

- **2029 No Project conditions**—Reflects future noise and vibration conditions in 2029 for all study locations, including reasonably foreseeable land use changes and transportation network modifications.
- **2029 Plus Project conditions**—Evaluates the potential impacts of project operations in 2029 for all study locations. This scenario reflects all modifications necessary to build the project along with HSR service and ridership at stations.
- **2040 No Project conditions**—Reflects future noise and vibration conditions in 2040 for all study locations, including reasonably foreseeable land use changes and transportation network modifications.
- **2040 Plus Project conditions**—Evaluates the full potential impacts of the project in 2040 for all study locations. This analysis scenario reflects all modifications necessary to build and operate the project.

2029 Versus 2040 Analysis

- 2029 analysis—Evaluates noise and vibration impacts for 2029 for all locations.
- 2040 analysis—Evaluates noise and vibration impacts for 2040. This analysis provides a conservative analysis along the length of the Project Section. Where significant impacts are identified, feasible mitigation is considered for those conditions. The mitigation would be implemented in 2029 to anticipate later significant noise and vibration impacts.

Noise impact assessments are all conducted by comparing future conditions to existing conditions. The results reported for No Project conditions are provided for informational purposes only.

Noise

Existing Noise

Analysts established existing noise levels in the noise RSA by taking extensive field noise measurements during programs conducted in 2009, 2010, 2013, 2016, and 2017. A total of 65 measurements of ambient noise were taken in the noise RSA. Long-term noise measurements (1 to 3 days in duration) were used to characterize the existing ambient noise in the RSA. Analysts obtained the maximum sound level (L_{max}), minimum sound level (L_{min}), and L_{eq} for each hour, and used the L_{eq} to calculate the L_{dn}.

Noise Level Terminology

- L_{max} is the maximum sound level
- L_{min} is the minimum sound level
- L_{eq} is the equivalent, energy-averaged RMS noise exposure over a given period (often for 1 or more hours)
- L_{dn} is the total noise exposure over a 24-hour period (day-night sound level) with a penalty added for sounds generated between 10 p.m. and 7 a.m.

The analysts selected locations for noise measurements throughout the RSA based on the environmental conditions expected in different areas of the communities along the alignment, the type of receptors potentially affected, the proximity of the receptors to a major arterial road or freeway, and the distance of the receptors (primarily residences) to the existing Caltrain tracks. Most of the selected measurement sites between San Jose and Gilroy are representative of receptors that are directly exposed to existing noise from Caltrain and other passenger and freight trains. In Pacheco Pass and the San Joaquin Valley, most of the selected measurement sites are representative of receptors that are directly exposed to existing noise from roadways. To categorize the dominant existing noise sources in the RSA, analysts located some measurement sites adjacent to roadways along the alignment, some sites near existing rail sources, some sites near existing roadway sources, and some sites near both existing rail and roadway sources.

Analysts used the field noise measurement data to validate an existing noise spreadsheet model based on the FTA guidance manual (FTA 2018) methodology. This validated model, which incorporates existing train operations, horn, and traffic noise, was then used to calculate existing ambient noise levels at all receptors. Volume 2, Appendix 3.4-A, provides additional information on this modeling approach.

Impact Criteria

Construction

The FRA guidance manual (FRA 2012) includes construction noise assessment criteria as shown in Table 3.4-4. Analysts used an 8-hour L_{eq} and a 30-day average noise exposure L_{dn} to assess impacts, a 30-day average L_{dn} to assess impacts in residential areas, and a 30-day average 24-hour L_{eq} to assess impacts in commercial and industrial areas. The noise emission levels of the construction equipment, utilization factor, hours of operation, and location of equipment are used to calculate 8-hour and 30-day average noise exposures. FRA assessment criteria are used throughout the RSA.

Table 3.4-4 Federal Railroad Administration Detailed Assessment Criteria for Construction Noise

Land Use	8-Hour L_{eq} (dBA)		L_{dn} / L_{eq} (dBA) 30-Day Average
	Day	Night	
Residential	80	70	75
Commercial	85	85	80[1]
Industrial	90	90	85[1]

Source: FRA 2012
[1] 24-hour L_{eq}, not L_{dn}
L_{eq} = equivalent sound level
L_{dn} = day-night sound level
dBA = A-weighted decibel

Operations

For the HSR system, analysts used noise impact criteria adopted by FRA (FRA 2012) to assess the contribution of noise from project construction and operations to the existing environment, along with noise impact criteria adopted by FTA (FTA 2018) to assess the contribution of noise from conventional-speed rail operations and stationary facilities. These guidelines establish methods for analyzing and assessing noise and vibration impacts. The FRA noise impact criteria are based on maintaining a noise environment considered acceptable for land uses where noise may have an impact. Land use also factors into the determination of impact; while impacts on industrial uses are not considered, places where people sleep or where quiet is an integral component of the land use require evaluation to determine if noise impact would occur and if mitigation is appropriate. Table 3.4-5 shows the three land use categories used by the FRA.

FRA noise impact criteria for human annoyance are based on the comparison of existing outdoor noise levels and future outdoor noise levels from the project. The FRA noise impact criteria specify a comparison of future with existing noise levels, because comparison of a projection with an existing condition is more reflective of an impact than a comparison of two projections. Noise-level increases are categorized as no impact, moderate impact, or severe impact. Moderate and severe impacts are defined as follows:

- **Moderate impact**—In this range of noise impact, the change in noise level is noticeable to most people, but may not be sufficient to cause strong, adverse reactions from the community. Project-specific factors would be considered to determine the magnitude of impact and the need for mitigation, including the number of affected noise-sensitive sites, the existing level of noise exposure, and the costs associated with mitigation.
- **Severe impact**—Project-generated noise in the severe impact range can be expected to cause a substantial percentage of people to be highly annoyed by the new noise levels. It is FRA policy to implement noise mitigation for sensitive receptors experiencing severe impacts unless there are truly extenuating circumstances that prevent implementation.

Table 3.4-5 Federal Railroad Administration Land Use Categories for Noise Exposure

Land Use Category	Noise Metric (dBA)	Land Use Category[1, 2]
1	Outdoor $L_{eq}(h)$[3]	Tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, and such land uses as outdoor amphitheaters and concert pavilions, as well as national historic landmarks with significant outdoor use. Also included are recording studios and concert halls.
2	Outdoor L_{dn}	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor $L_{eq}(h)$[1]	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, theaters, and churches, where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, and museums can be considered to be in this category. Certain historical sites, parks, campgrounds, and recreational facilities are also included.

Source: FRA 2012

[1] Parks are only considered to be noise sensitive if the park is used in a manner that is noise sensitive; active outdoor land uses, for example, such as pedestrian and bike paths, are not considered noise sensitive.

[2] Historic sites and properties protected under Section 4(f) of the U.S. Department of Transportation Act and Section 106 of the National Historic Preservation Act are not intrinsically noise-sensitive; inclusion in noise-sensitive land use categories is dependent upon land use activities (e.g., if outdoor interpretation is a critical component of a historic site, then the site would be included in Category 1).

[3] L_{eq} for the noisiest hour of transit-related activity during hours of noise sensitivity.

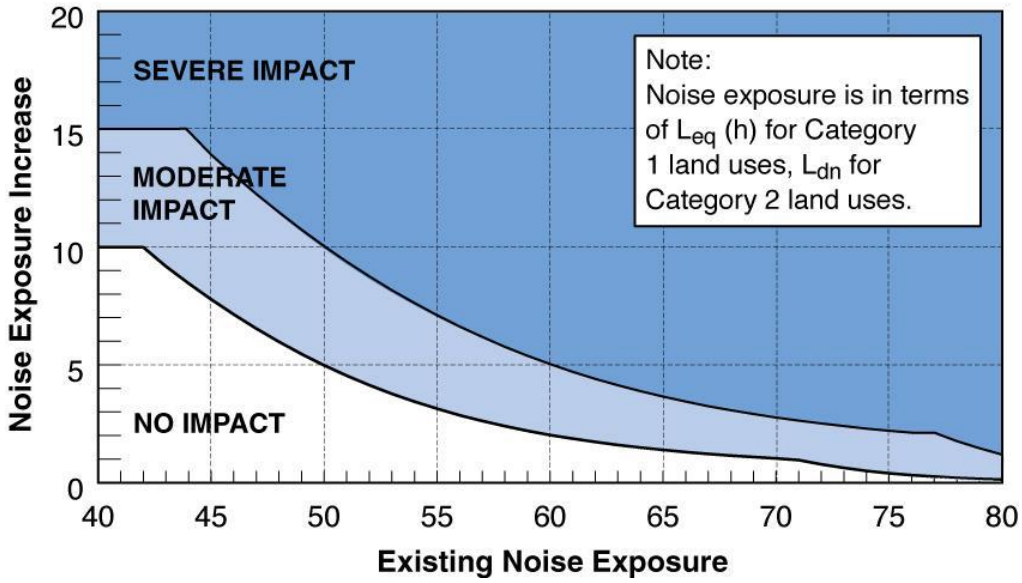
dBA = A-weighted decibel

L_{dn} = day-night sound level

$L_{eq(h)}$ = hourly equivalent sound level

The FRA criteria are presented in terms of relative levels for evaluating the total future noise exposure increases, or increases in cumulative noise exposure, from the project alternatives. If the existing noise were dominated by a source that changed because of the project, it would be incorrect to add the project noise to the existing noise. Therefore, the relative form of the noise criteria must be used for projects involving proposed changes to an existing rail transit system, such as a shift in the location or profile of existing passenger or freight tracks or a change in the vehicle technology. Figure 3.4-4 illustrates the relative form of the criteria as they apply to Category 1 and 2 land uses and Figure 3.4-5 illustrates the criteria as they apply to Category 3 land uses. These criteria are based on the increase of the existing ambient noise level associated with project operations and can be used to evaluate the project in combination with other new planned projects (i.e., cumulative impact). These criteria are applied to the outside of building locations at noise-sensitive areas.

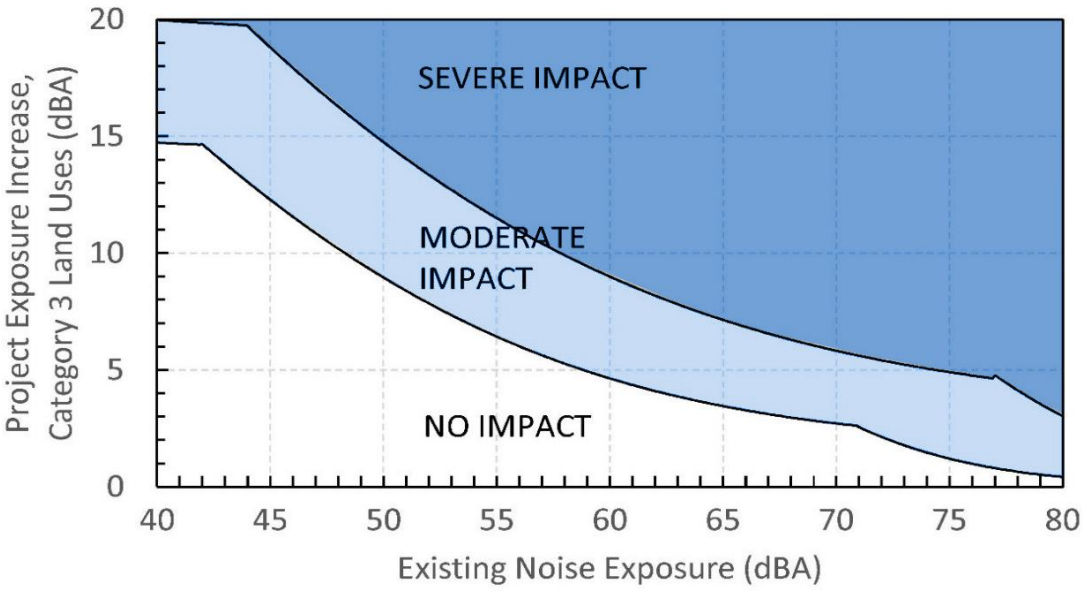
To determine the severity of a noise impact, analysts determine the land use category (Table 3.4-5), apply the appropriate noise metric (L_{dn} or L_{eq}), determine the existing exterior noise exposure for each receptor or group of similar receptors, and then determine project noise exposure or the cumulative noise exposure associated with the project alternatives and other projects using the data illustrated on Figure 3.4-4 and Figure 3.4-5.



Source: FRA 2012

FEBRUARY 2019

Figure 3.4-4 Allowable Increase in Cumulative Noise Levels (Land Use Categories 1 and 2)



Source: FRA 2012

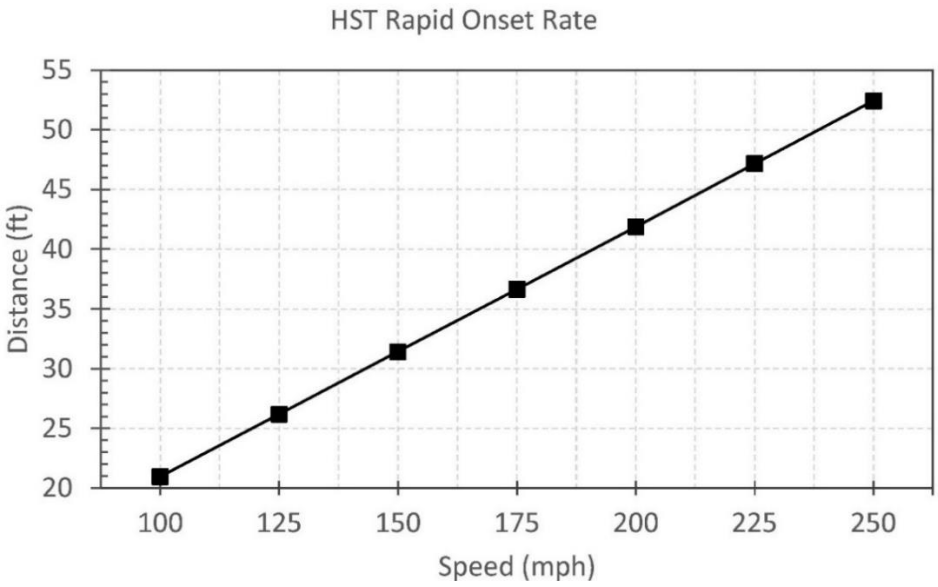
FEBRUARY 2019

Figure 3.4-5 Allowable Increase in Cumulative Noise Levels (Land Use Category 3)

Consider a hypothetical residential property (Category 2) that has an existing noise exposure of L_{dn} 60 dBA. The noise exposure resulting from the project plus regional growth and other planned projects could result in a project noise level exposure of L_{dn} 65 dBA. Combining the project noise

with the existing noise level[3] would result in a total combined noise exposure of L_{dn} 66 dBA or a potential increase of 6 dBA over the existing noise level. Volume 2, Appendix 3.4-A, provides further details. Using Figure 3.4-4, one would start with the horizontal axis at 60 dBA for the existing condition to draw a vertical line, and then draw a horizontal line from 6 dBA on the left-hand axis. The intersection of these two lines determines the severity of impact. In this hypothetical example, the intersection of these two lines would fall in the severe impact range.

An additional environmental concern for project operations is the rapid rise in sound level that can occur for trains traveling at very high speeds. Under certain conditions, a rapid rise of sound level can result in a startle effect, particularly for a receptor near the tracks. The rate at which train sound levels increase is referred to as the *onset rate* and is a function of train speed and distance from the tracks. Research has found that a sudden increase in sound (i.e., a rapid onset rate) can result in greater annoyance than sounds of similar levels that vary less rapidly or are steady. When onset rates exceed about 30 dB/second, people tend to be startled or surprised by the sudden onset of the sound. Figure 3.4-6 illustrates the potential for startle as a function of train speed and distance from the train.



Source: FRA 2012

FEBRUARY 2019

Figure 3.4-6 Distance from Tracks within which Startle Can Occur for HSR

The FRA guidance manual (FRA 2012) states that the understanding of startle effects to date is partially based on using U.S. Air Force research for sudden onset of noise from aircraft. The guidance describes a number of unresolved issues regarding application of the U.S. Air Force research to determine the startle effects of high-speed rail, such as the scheduled nature, lower sound levels, and lower onset rates of train passbys compared to military aircraft flights. The FRA guidance further states that without better definition of the application of results of noise from aircraft overflights to noise from high-speed rail passbys, it is appropriate to consider startle effects as “additional information” included in high-speed rail impact assessments as opposed to being included in the calculation of noise exposure itself. The FRA guidance does not provide a threshold in the form of an “onset rate that could be considered significant enough to cause startle on a regular basis.” Thus, the 30 dB/second onset rate described above is considered

[3] Decibels are added logarithmically; 10 times the logarithm of 2 is 3 dB, so that 60+60 = 63 dB. Adding a smaller number to a larger number raises the latter by no more than 3 dB. Thus, 60+65 = 66 in decibels

indicative of when startle can occur, but is not considered a significance threshold for determining when startle would occur on a regular basis.

The FRA guidance manual (FRA 2012) also addresses potential impacts on livestock animals (cattle, other livestock, and poultry). The land use along the project corridor changes from urban and suburban to rural farmland, including some areas with domestic and wild animals. Table 3.4-6 shows noise exposure limits for screening.

Table 3.4-6 Interim Criteria for High-Speed Rail Train Noise Impacts on Livestock

Animal Category	Class	Noise Metric	Noise Level (dBA)
Livestock	Mammals (livestock)	SEL	100
	Birds (poultry)	SEL	100

Source: FRA 2012
dBA = A-weighted decibel
SEL = Sound Exposure Level

Prediction Methods

Construction Noise

Analysts assessed construction noise impacts according to the method described in the FRA guidance manual (FRA 2012). Construction noise estimates are always approximate because of the lack of specific information available at the time of the environmental analysis. The contractor would make decisions about the procedures and equipment to be used. Project designers try to minimize constraints on how construction would be performed and which equipment would be used to facilitate cost-effective construction. Nevertheless, estimated construction scenarios for typical railroad construction projects allow a quantitative construction noise assessment by comparing the predicted noise levels with impact criteria appropriate for the construction stage. The methods include the following data:

- Noise emissions from equipment expected to be used by contractors during typical construction activity types
- Usage scenarios for how the equipment would be operated
- Estimated site layouts of equipment along the right-of-way
- Relationship of the construction operations to nearby noise-sensitive receptors

Project construction would also necessitate Pacific Gas and Electric (PG&E) network upgrades. The construction noise impact assessment for these upgrades follows the same methods as the typical construction noise activities. Analysts identified construction scenarios specific to the PG&E upgrades along with equipment expected to be used by contractors. It is anticipated that helicopters would be used for the PG&E upgrades; therefore, the analysis specifically accounts for the noise from helicopter movements and hovering over construction sites.

Operations Noise

The method to assess operations noise impacts is consistent with the detailed analysis approach established in the FRA guidance manual (FRA 2012). For noise from stations, yard and maintenance facilities, and noise from conventional railroad noise sources, the noise analysis is consistent with the methods outlined in the FTA guidance manual (FTA 2018). This section describes the methods for assessing potential noise impacts from train operations under the No Project Alternative and project alternatives in 2029 and 2040; horn noise; impacts associated with the rapid onset of passing HSR trains; and noise impacts of stations, maintenance facilities, and vehicular traffic. These analyses take into account the existing noise conditions, which include airport, highway, railroad, and industrial sources.

Train horn noise is an important feature of the project in areas that would not be fully grade separated, particularly between Scott Boulevard and south of downtown Gilroy where existing

train operations sound warning horns approaching at-grade crossings and Caltrain passenger stations, and with Alternative 4, which includes blended HSR service with Caltrain service. Existing Caltrain locomotives feature horns at 16 feet above top of rail (ATOR) that produce a maximum sound level of 96 dBA at 100 feet from the track. Future Caltrain EMUs will feature horns mounted at 3 feet ATOR with a maximum sound level of 96 dBA at 100 feet from the track. Freight trains feature horns at 16 feet ATOR with a maximum sound level of 107 dBA at 100 feet from the track. Future HSR trains would feature horns mounted at 7 feet ATOR with a maximum sound level of 96 dBA at 100 feet from the track. Volume 2, Appendix 3.4-A, contains additional information about train horns.

The analysis of project operations in 2029 and 2040 assumes HSR service for Phase 1, which would connect San Francisco with Los Angeles via the Central Valley. Train service would include revenue service trains and nonrevenue services trains with daily trips to and from the proposed maintenance of way facility (MOWF) near Gilroy. Table 3.4-7 shows the number of daily HSR trains for various portions of the project extent. The number of daily trains would be the same under all four project alternatives. Volume 2, Appendix 3.4-A, provides a detailed discussion of assumptions used for vehicle technology, train lengths, track configurations, and design speeds.

Table 3.4-7 Assumed 2029 and 2040 Project Operations for Noise Impact Assessment

Segment	Total Number of HSR Trains (Both Directions) - 2029			Total Number of HSR Trains (Both Directions) - 2040		
	Daytime[1]	Nighttime[2]	Peak Hour (Approximate)	Daytime[1]	Nighttime[2]	Peak Hour (Approximate)
Scott Boulevard to San Jose Diridon Station	40	8	4	108	26	8
San Jose Diridon Station to Gilroy Station	40	8	4	148	28	14
Gilroy Station to Gilroy MOWF	40	8	4	148	28	14
Gilroy MOWF to San Joaquin Valley	40	8	4	148	28	14

LMF = light maintenance facility
MOWF = maintenance of way facility
[1] Daytime is defined as the period between 7:00 a.m. and 10:00 p.m.
[2] Nighttime is defined as the period between 10:00 p.m. and 7:00 a.m.

Analysts developed noise predictions based on the noise source reference levels for the specific vehicle technology proposed for the HSR system provided in the FRA guidance manual (FRA 2012) for a very high-speed EMU train. The noise source reference levels for very high-speed EMU trains are included in Table 4-6 of Volume 2, Appendix 3.4-A, Noise and Vibration Technical Report and in Table 5-2 of the FRA guidance manual (FRA 2012). Noise predictions accounted for the proposed operations schedule, ground propagation attenuation impacts, cross-sectional geometry of the trackway and superstructure (e.g., elevated guideway), and shielding provided by existing noise barriers and intervening rows of buildings. Analysts adjusted predicted noise levels to account for increases in localized noise because of special trackwork, such as crossovers or turnouts, or from insulated joints. Standard frogs (rail hardware where tracks cross one another) in crossovers and turnouts typically cause a localized increase in noise from train operations. Alternatives 1, 2, and 3 would use special trackwork, such as movable-point frogs, to avoid significant gaps in the rail running surface. Any insulated joints would be low-impact joints. Therefore, any increases in localized noise because of special trackwork with Alternatives 1, 2,

and 3 would likely be small and would not change overall impacts on sensitive receptors. Alternative 4 would use the same type of special trackwork as currently exists in the corridor. All special trackwork frogs in the San Jose to Central Valley Wye Project Extent for Alternative 4 were assumed to be standard frogs.

The analysis of project operations in 2029 and 2040 also evaluates the planned changes in Caltrain train operations for blended service under Alternative 4 between San Jose and Gilroy based on methods described in the FTA guidance manual for conventional-speed railroads. PCEP will electrify the Caltrain Corridor between San Francisco and Tamien Station in San Jose, convert approximately 75 percent of diesel-locomotive hauled coaches to EMUs, and increase service to six trains per peak hour per direction (PCJPB 2015). These changes to Caltrain service would change the existing noise environment in the RSA from the Tamien Station north; therefore, the Caltrain PCEP is evaluated as part of the analysis of HSR project operations in 2029 and 2040. In addition, with Alternative 4, Caltrain operations between Tamien Station and Gilroy would change in several ways because of blended service. First, all Caltrain service between Tamien Station and Gilroy would be with EMUs instead of diesel-locomotive–hauled coaches. Second, Caltrain service would increase from three trains northward in the morning and three trains southward in the evening to six trains northward in the morning and six trains southward in the morning. This increase in service is due to the need to institute skip-stop service in order to facilitate efficient blended operations, while at the same time allowing for the same number of overall daily Caltrain service at the stations between Tamien Station and Gilroy.

Analysts also evaluated changes in horn noise associated with project operations. Construction of dedicated HSR infrastructure with Alternative 1 would eliminate one existing at-grade railway crossing at Bloomfield Avenue in Gilroy, eliminating horn noise at that location. Alternative 2 would be predominantly located on an embankment in or adjacent to the existing Caltrain/Union Pacific Railroad (UPRR) railway, which would eliminate 33 existing at-grade crossings where trains currently sound warning horns (Volume 2, Appendix 3.4-A, specifies these locations). Alternatives 3 and 4 would not eliminate any existing at-grade crossings, so trains would continue to sound warning horns as they approach at-grade crossings and passenger stations. Alternative 4, HSR trains would sound horns as they approach at-grade crossings and passenger stations. To assess changes in horn noise associated with the project alternatives, analysts used existing field noise measurements of passenger and freight trains and applied the horn noise model (FRA 2000) to receptors within 0.25 mile of locations where horns must be sounded. The analysts set the noise from the HSR train horn at the same level as the Caltrain horn where HSR would operate on Caltrain tracks (Alternative 4). Analysts also accounted for crossing bells near existing at-grade crossings in the noise measurement program, and modeled this based on the methods in the FTA guidance manual (FTA 2018).

In addition to predicting noise levels associated with train operations, analysts evaluated noise impacts associated with other noise sources including HSR passbys, station noise, maintenance facility noise, and vehicle traffic noise. A brief overview of the methods for each of these evaluations is as follows (Volume 2, Appendix 3.4-A, provides additional details):

- **Startle and annoyance from rapid onset of HSR passbys—**Analysts used an onset rate of 30 dBA per second and the FRA impact criteria illustrated on Figure 3.4-4 to establish distances from the track centerlines within which startle effects would likely be experienced. Analysts compared these distances from the outermost track centerline to the location of sensitive receptors beyond the access-restricted right-of-way to identify receptors that would experience startle and annoyance from the rapid onset of HSR passbys.
- **Station noise—**Analysts assessed the impacts of station noise associated with train movements and vehicular traffic on nearby noise-sensitive receptors according to methods summarized in Section 5.2 of the FRA guidance manual (HSR train operations) and Section 4.4 of the FTA guidance manual (parking facilities) (FRA 2012; FTA 2018). Noise levels associated with HSR train operations were modeled based on the train operating schedules, equipment type, speed profile, and track configuration. Analysts used the station plan layouts and number of planned parking spaces to predict the noise exposure from the

parking facilities at nearby noise-sensitive receptors. A reference SEL of 92 dBA at 50 feet distance corresponding to 1,000 cars in a peak activity hour (derived from the FTA guidance manual Section 4.4) was used to predict the additional noise from the parking lots at each of the HSR stations. Analysts tabulated the predicted noise levels from HSR trains at the stations and from the parking facilities along with the existing ambient noise exposures, and determined levels of impact (no impact, moderate impact, or severe impact) by comparing the existing and projected noise exposure to the impact criteria illustrated on Figure 3.4-3 and Figure 3.4-4.

- **Maintenance facility noise—**Analysts used the methods in Section 4.4 of the FTA guidance manual (FTA 2018) to predict noise exposure from the MOWF near Gilroy. A reference SEL of 118 dBA at 50 feet distance corresponding to 20 train movements in a peak-activity hour was used to predict noise from the facility. Analysts used the planned MOWF layouts and number of movements per day to calculate noise exposure at nearby noise-sensitive receptors. Analysts then combined the predicted noise levels from the MOWF with the project operations noise predictions and compared this to the impact criteria.
- **Vehicle traffic noise—**Analysts assessed changes in noise levels resulting from increased vehicle traffic volumes near the HSR stations and MOWF. Daily traffic volumes for roadway segments near the HSR stations and MOWFs for each project alternative were compared to existing traffic volumes. Consistent with FRA guidance (FRA 2012), traffic growth factors under the No Project Alternative and the project alternatives were calculated to assess noise levels. At locations where the growth factors for a project alternative resulted in a 3 dB or greater increase in noise (equivalent to a doubling of traffic volumes), analysts evaluated the increase in traffic volume that would be related to the project. Volume 2, Appendix 3.4-A, provides additional information regarding this analysis.
- **Traction power substation noise—**In addition to the noise generated by other project operations, noise would also be generated by electrical traction power facilities (substations, switching stations, and paralleling stations). Traction power substations (TPSS) would each encompass approximately 32,000 square feet (200 feet by 160 feet) at approximately 30-mile intervals, and include two 115/50 kilovolt or 230/50 kilovolt single-phase transformers at 60 megavolt amperes. The traction power switching stations would be required at approximately 15-mile intervals, midway between the TPSSs, would encompass approximately 14,400 square feet (160 by 90 feet), and would contain two (10 to 60 megavolt amperes) transformers. Traction power paralleling stations would be required at approximately 5-mile intervals between the traction power switching stations and the TPSSs, would encompass approximately 9,600 square feet (120 by 80 feet), and would contain one or two (10 to 60 megavolt amperes) transformers.

  FRA guidance does not have its own analysis techniques for traction power facilities because these facilities are not unique to HSR systems. Instead, they reference the FTA method. Thus, FTA reference levels were used to calculate the total project noise level at the receptors identified within the screening distance. The FTA reference SEL for substations is 99 dBA at 50 feet, which equates to an L_{dn} of 70 dBA at 50 feet (assuming continuous 24-hour usage).

Vibration

Existing Vibration

Analysts selected measurement sites to capture overall ground vibration as well as spectral components (frequency content of the ground vibration) of the train passbys, which are influenced by local soil conditions and input forces unique to different types of trains. Sites with a high potential for vibration impacts were prioritized, and because Caltrain train vibration is the dominant existing source of ground vibration in most of the project extent, the vibration survey focused on obtaining ground vibration measurements during Caltrain passbys at typical setback distances of the sensitive receptors from the nearest track. Analysts measured the existing vibration levels at 14 locations in the vibration RSA.

Results of the ambient vibration survey indicate existing overall vibration levels throughout the corridor varied based on the Caltrain speed and the degree of variability in soil vibration attenuation characteristics. Analysts used these factors in the selection of field vibration propagation testing locations for testing that was performed for the detailed vibration analysis.

Impact Criteria

Construction

The construction vibration assessment is based on the FRA guidance manual (FRA 2012), which covers potential impacts on buildings and potential annoyance to building occupants. Table 3.4-8 shows the FRA guidelines for vibration damage criteria from construction activity. These limits were used to identify areas that should be addressed during engineering design of the project.

Table 3.4-8 Federal Railroad Administration Construction Vibration Damage Criteria

Building Category	PPV (in/sec)	Approximate L_v[1]
I. Reinforced-concrete, steel or timber (no plaster)	0.5	102
II. Engineered concrete and masonry (no plaster)	0.3	98
III. Nonengineered timber and masonry buildings	0.2	94
IV. Buildings extremely susceptible to vibration damage	0.12	90

Source: FRA 2012
[1] RMS VdB re: 1 microinch per second.
in/sec = inches per second
L_v = velocity level
PPV = peak particle velocity
RMS = root-mean-square
VdB = vibration decibel

To analyze temporary annoyances to building occupants during the nighttime period or interference with vibration-sensitive equipment inside special-use buildings during construction, FRA recommends using the long-term operations vibration criteria for a general assessment.

Operations

Vibration impact levels are determined by the type of land-uses affected, the number of daily vibration events, and the type of analysis being conducted (i.e., ground-borne vibration or ground-borne noise). FRA provides guidelines to assess the human response to different levels of ground-borne noise and vibration, as shown in Table 3.4-9. Ground-borne noise and vibration levels represent the vibration during a train passby (RMS vibration level of an event). The guidelines provide additional criteria for special-use buildings that are sensitive to ground-borne noise and vibration, as shown in Table 3.4-10. Analysts considered the number of daily train events (more than 70 trains per day indicates that HSR service would be considered a frequent event), and applied the criteria in Table 3.4-9 and Table 3.4-10 to occupied spaces in potentially affected buildings (i.e., receptors). Ground-borne vibration is assessed at the building façade; ground-borne noise is assessed inside buildings.

For most train operations, airborne noise is significantly louder than ground-borne noise, and ground-borne noise is not perceived separately from the airborne noise. Therefore, analysts evaluated airborne noise to assess at-grade or aerial portions of the alignment and ground-borne noise to assess portions of the alignment in tunnel.

Table 3.4-9 Ground-Borne Vibration and Ground-Borne Vibration Impact Criteria for General Assessment

Land Use Category	Ground-Borne Vibration Impact Levels (VdB re: 1 µin/sec)			Ground-Borne Vibration Impact Levels (dB re: 20 µPa)		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 1: Buildings where vibration would interfere with interior operations	65 VdB[4]	65 VdB[4]	65 VdB[4]	N/A[5]	N/A[5]	N/A[5]
Category 2: Residences and buildings where people normally sleep	72 VdB	75 VdB	80 VdB	35 dBA	38 dBA	43 dBA
Category 3: Institutional land uses with primarily daytime use	75 VdB	78 VdB	83 VdB	40 dBA	43 dBA	48 dBA

Source: FRA 2012
[1] *Frequent Events* is defined as more than 70 vibration events of the same kind per day.
[2] *Occasional Events* is defined as between 30 and 70 vibration events of the same kind per day.
[3] *Infrequent Events* is defined as fewer than 30 vibration events of the same kind per day.
[4] This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration-sensitive manufacturing or research would require detailed evaluation to define the acceptable vibration levels. Making sure vibration levels in a building are low often requires special design of the heating, ventilation, and air-conditioning systems and stiffened floors.
[5] Vibration-sensitive equipment is not sensitive to ground-borne noise.
µin/sec = microinch per second
µPa = micro-Pascal
dB = decibel
dBA = A-weighted decibel
N/A = not applicable
VdB = vibration decibels

Table 3.4-10 Ground-Borne Vibration and Ground-Borne Noise Impact Criteria for Special Use Buildings

Land Use Category	Ground-Borne Vibration Impact Levels (VdB re: 1 µin/sec)		Ground-Borne Noise Impact Levels (dB re: 20 µPa)	
	Frequent Events[1]	Infrequent Events[2]	Frequent Events[1]	Infrequent Events[2]
Concert halls	65 VdB	65 VdB	25 dBA	25 dBA
TV studios	65 VdB	65 VdB	25 dBA	25 dBA
Recording studios	65 VdB	65 VdB	25 dBA	25 dBA
Auditoriums	72 VdB	80 VdB	30 dBA	38 dBA
Theaters	72 VdB	80 VdB	35 dBA	43 dBA

Source: FRA 2012
[1] *Frequent Events* is defined as more than 70 vibration events per day.
[2] *Occasional or Infrequent Events* is defined as fewer than 70 vibration events per day.
VdB = vibration decibels
µin/sec = microinch per second
dB = decibel
µPa = micro-Pascal
dBA = A-weighted decibel

The analysts applied additional vibration criteria where the project would be located in the existing rail corridor from San Jose to Gilroy. When there are existing significant sources of vibration (e.g., trains) at locations affected by the project, existing vibration levels were factored into the assessment. FRA provides guidance on how to apply the vibration impact criteria based on the number of daily train operations and the degree to which existing railroad tracks would be relocated. Volume 2, Appendix 3.4-A, Noise and Vibration Technical Report, summarizes how vibration impact criteria are applied in existing rail corridors based on train frequency; each of these types of existing rail corridors is present in a portion of the project extent. Analysts separately compared the project's vibration levels to the criteria listed in Table 3.4-9 and Table 3.4-10. Appendix 3.4-A in Volume 2 provides more information on this analysis.

Prediction Methods

Construction Vibration

Analysts assessed construction vibration impacts in accordance with Chapter 10 of the FRA guidance manual (FRA 2012) for quantitative construction vibration assessments. HSR construction activity scenarios were developed to estimate construction vibration quantitatively, comparing the predicted ground-borne vibration levels with appropriate construction stage impact criteria. The quantitative construction vibration analysis was conducted where there would be a potential for blasting, pile driving, vibratory compaction, demolition, or excavation near vibration-sensitive structures. Criteria for annoyance (Table 3.4-9 and Table 3.4-10) and damage (Table 3.4-8) were applied to determine the impacts from construction vibration. Analysts used the following information to assess the construction vibration levels:

- Vibration source levels from equipment expected to be used by contractors
- Estimated site layouts of equipment along the right-of-way
- Distance from the construction activities to nearby vibration-sensitive receptors

Operations Vibration

The FRA guidance manual (FRA 2012) provides three levels of analysis: screening, general assessment, and detailed analysis. The screening analysis was used to determine the RSA for conducting the detailed analysis of operational vibration. For this analysis, analysts evaluated residential locations within 275 feet and institutional locations within 220 feet of the alternatives' centerlines.

Ground-borne noise is generated when interior building surfaces such as floors, walls, and ceilings vibrate because of ground-borne vibration (e.g., from trains). Ground-borne noise is commonly described as the "rumble" from a subway train. The prediction of such noise is directly related to the prediction of vibration inside a building.

The FRA criteria for assessing ground-borne vibration from shared corridors require that the vibration levels resulting from the relocated existing tracks be compared to the existing vibration levels. Thus, analysts prepared separate analyses to predict ground-borne vibration from project operations and from existing and future Caltrain operations. This analysis was conducted using the FRA's prediction model for ground-borne vibration, which is an empirical modeling approach that is described in detail in Volume 2, Appendix 3.4-A.

In accordance with FRA guidance, vibration levels from HSR on an aerial structure were assumed to be 10 VdB less than vibration from at-grade or embankment track. Appendix 3.4-A in Volume 2 details the modeling inputs and assumptions used for this assessment.

As with the noise analysis, analysts adjusted predicted vibration levels to account for increases in localized noise because of special trackwork, such as crossovers or turnouts, or from insulated joints. Standard frogs in crossovers and turnouts typically cause a localized increase in vibration from train operations. Alternatives 1, 2, and 3 would use special trackwork, such as movable-point frogs, to avoid significant gaps in the rail running surface. Any insulated joints would be low-impact joints. Therefore, any increases in localized vibration because of special trackwork under Alternatives 1, 2, and 3 would likely be small and would not change overall impacts on sensitive receptors. Alternative 4 would use the same type of special trackwork as currently exists in the corridor. All special trackwork frogs under Alternative 4 were assumed to be standard frogs.

3.4.4.4 Method for Evaluating Impacts under NEPA

The CEQ NEPA regulations (40 C.F.R. Parts 1500–1508) provide the basis for evaluating project impacts (described in Section 3.1.6.4). As described in Section 1508.27 of these regulations, the criteria of context and intensity are considered together when determining the severity of the change introduced by the project.

- **Context**—For this analysis, the context for noise impacts is the background noise and sensitivity of receptors. Rural residential has less noise and fewer receptors versus urban residential near existing noise emitters, such as railroads and freeways. For vibration analysis, the context is the existing land use.
- **Intensity**—For this analysis, intensity is determined by assessing the degree to which construction and operations of the project would change noise and vibration levels, using FRA guidelines (see impact criteria for noise and vibration in Section 3.4.4.3, Methods for Impact Analysis). These guidelines contain criteria for determining whether project-generated noise or vibration would result in an impact and of what severity.

3.4.4.5 Method for Determining Significance under CEQA

CEQA requires an EIR to identify the significant environmental impacts of a project (CEQA Guidelines § 15126). One of the primary differences between NEPA and CEQA is that CEQA requires a threshold-based impact analysis. Significant impacts are determined by evaluating whether project impacts would exceed the significance threshold established for the resource (as presented in Section 3.1.6.4). By contrast, under NEPA, significance is used to determine whether an EIS will be required; NEPA requires a federal lead agency to prepare an EIS when the proposed federal action (project) as a whole has the potential to "significantly affect the quality of the human environment." Accordingly, Section 3.4.9, CEQA Significance Conclusions, summarizes the significance of the environmental impacts on noise and vibration for each project alternative. The Authority uses the following thresholds to determine if a significant impact from noise and vibration would occur as a result of the project. A significant impact is one that would:[4]

- Generate a substantial temporary or permanent increase in ambient noise levels in excess of severe impact standards for a severe impact established by FRA for high-speed ground transportation and by FTA for transit projects.
- Generate excessive ground-borne vibration or ground-borne noise levels.

As discussed in Section 3.4.4.4, Method for Determining Significance under NEPA, the analysis relies on noise and vibration standards developed by FTA and FRA to determine whether the project would result in significant noise or vibration impacts. These standards are derived primarily from the FRA guidelines in *High-Speed Ground Transportation Noise and Vibration Impact Assessment* (FRA 2012), which is based on the FTA *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018). The noise impact criteria established in these documents is based on the level of human annoyance and were developed to apply to a wide variety of surface transportation modes and to respond to the varying sensitivities of communities to projects under different background noise conditions. The vibration standards address both human reaction to vibration as well as the potential for physical damage. The FRA standards were developed specifically for assessing noise and vibration impacts caused by high-speed rail projects, and the FTA standards were developed for rail projects and their associated stationary facilities. Accordingly, these standards serve as appropriate thresholds for determining whether the project would result in significant noise or vibration impacts.

For determining the significance of impacts related to traffic noise, the analysis relies in part on criteria that are included in FHWA's *Procedures for Abatement of Highway Traffic Noise and*

[4] Appendix G of the CEQA Guidelines includes a criterion related to exposing people associated with the project to excessive noise associated with an airport. This project does not include any residential or commercial development near airports. As such, this criterion does not apply and is not included in this analysis.

Construction Noise (23 C.F.R. Part 772), which are implemented by Caltrans through its *Traffic Noise Analysis Protocol* (Caltrans 2011). These criteria are based on the level of human perception or annoyance and consider various types of land uses. Although the FHWA regulations only apply to projects funded or approved by FHWA, the criteria in these regulations are regularly considered in assessing noise impacts associated with motor vehicles. Moreover, the Caltrans *Traffic Noise Analysis Protocol* provides policy guidance for assessing traffic noise impacts as well as noise abatement criteria. Therefore, the criteria provided in these documents serve as appropriate thresholds for determining whether traffic noise would result in a significant impact.

Section 3.4.4.3, Methods for Impact Analysis, describes the federal noise standards and impact criteria used to determine the significance of noise impacts.

3.4.5 Affected Environment

3.4.5.1 Noise

This section summarizes the noise measurement results and describes the noise-sensitive land uses in the RSA. Section 3.4.4.3 provides a summary of the existing noise model used to identify the existing ambient noise conditions at all noise-sensitive receptors in the RSA.

Noise Measurement Results

A total of 65 measurements of ambient noise were conducted in the noise RSA. Analysts measured ambient noise at 11 locations in the San Jose Diridon Approach Subsection, 10 locations in the Monterey Corridor Subsection, 36 locations in the Morgan Hill and Gilroy Subsection, 2 locations in the Pacheco Pass Subsection, and 6 locations in the San Joaquin Valley Subsection. These measurement locations are mapped in Volume 2, Appendix 3.4-A.

Table 3.4-11 shows the results of the ambient noise measurements conducted between 2009 and 2017.[5] The major noise source for much of the RSA is existing rail corridors. In some locations, the project alignment deviates from existing rail corridors and extends through rural areas in a new transportation right-of-way, while in other areas the alignment is adjacent to major highways where the existing noise environment is dominated by traffic noise. Analysts used the measurement results in Table 3.4-11 to validate the existing noise spreadsheet model and predict existing noise levels at all noise-sensitive locations throughout the project. Appendix B of the Noise and Vibration Technical Report, which is provided in Appendix 3.4-A in Volume 2 of this document, contains measurement site photos and plots of ambient noise measurement results.

Table 3.4-11 Ambient Noise Measurement Results

Site	Location	Land Use	Date Deployed	Average L_{dn}[1] (dBA)	Loudest Hour L_{eq} (dBA)
San Jose Diridon Station Approach Subsection					
N76[2]	2079 Main Street, San Jose	Residential	5/3/2016	63	65
N77[2]	1315 De Altura Commons, San Jose	Residential	10/16/2009	65	64
N78[2]	726 Emory Street, San Jose	Residential	3/5/2010	64	65
N79	(adjacent to) 109 Laurel Grove Avenue, San Jose	Residential	5/10/2016	67	70
N80	421 Illinois Avenue, San Jose	Residential	10/12/2010	68	69

[5] The noise analysis includes noise measurements conducted in 2009 and 2010 by the Authority's contractors for the *Draft San Jose to Merced Project Section Noise and Vibration Technical Report* (Authority 2011) and the *San Francisco to San Jose Project Section Noise and Vibration Technical Report* (Authority and FRA 2014); noise measurements conducted in 2013 as part of the *Caltrain Peninsula Corridor Electrification Project Noise and Vibration Technical Report* (Wilson Ihrig 2014); and noise measurements conducted in 2016 and 2017 as part of this assessment.

Site	Location	Land Use	Date Deployed	Average L_{dn}[1] (dBA)	Loudest Hour L_{eq} (dBA)
N81	663 Delmas Avenue, San Jose	Residential	5/6/2016	61	63
N82	827 Harliss Avenue, San Jose	Residential	10/12/2010	63	62
N83	(adjacent to) 974 McLellan Avenue, San Jose	Residential	5/17/2016	66	63
N84	1197 Lick Avenue, San Jose	Residential	11/11/2014	77	77
N139	782 Auzerais Avenue, San Jose	Residential	5/20/2013	82	81
N140	748 Illinois Avenue, San Jose	Residential	5/20/2013	71	68
Monterey Corridor Subsection					
N85	2320 Canoas Garden Avenue (Lot 608), San Jose	Residential	10/11/2010	67	67
N86	Communications Hill Drive, San Jose	Residential	5/17/2016	61	62
N87	3200 Monterey Road, Clarion Inn, San Jose	Residential	5/17/2016	79	77
N88	4406 Pinon Place, San Jose	Residential	10/13/2010	67	66
N89	23 Park Groton Place, San Jose	Residential	10/12/2010	68	63
N90	4635 Rotherhaven Way, San Jose	Residential	5/12/2016	77	77
N91	510 Saddle Brook Drive (Lot A), San Jose	Residential	5/12/2016	67	67
N92	5272 Waterfall Court, San Jose	Residential	10/19/2010	67	66
N93	60 Foxwell Place, San Jose	Residential	5/10/2016	74	75
N94	5919 Southwind Drive, San Jose	Residential	10/13/2010	73	76
Morgan Hill and Gilroy Subsection					
Along Monterey Road through Downtown Gilroy					
N95	6908 Sessions Drive, San Jose	Residential	10/13/2010	59	58
N96	6998 Sessions Drive, San Jose	Residential	5/10/2016	72	72
N97	7307 Urshan Way San Jose	Residential	10/14/2010	60	58
N98	7465 Pegasus Court San Jose	Residential	1/17/2011	61	59
N99	8470 Monterey Road, San Jose	Residential	1/18/2011	61	62
N100	586 Monterey Road, Morgan Hill	Residential	5/10/2016	81	81
N101	(adjacent to) 19271 Saffron Drive, Morgan Hill	Residential	5/9/2016	73	76
N103	19260 Monterey Road, Morgan Hill	Residential	10/18/2010	71	71
N104	157 Bender Circle, Morgan Hill	Residential	5/3/2016	68	69
N106	95 E Central Avenue, Morgan Hill	Residential	10/18/2010	66	66
N108	16250 Railroad Avenue, Morgan Hill	Residential	6/22/2010	68	68
N111	14542 Crowner Avenue, San Martin	Residential	5/12/2016	62	66
N113	13455 Monterey Road, San Martin	Residential	10/19/2010	69	69
N114	13150 Depot Road, San Martin	Residential	5/3/2016	64	67
N115	12675 Sycamore Avenue, San Martin	Residential	5/9/2016	67	66
N118	110 Jacob Way, Gilroy	Residential	6/22/2010	74	70
N120	325 Denio Avenue, Gilroy	Residential	10/21/2010	56	56

Site	Location	Land Use	Date Deployed	Average L_{dn}[1] (dBA)	Loudest Hour L_{eq} (dBA)
N121	25 Denio Avenue, Gilroy	Residential	10/20/2010	68	68
N122	70 Cohansey Avenue, Gilroy	Residential	10/20/2010	60	61
N124	(adjacent to) 120 Sarafina Way, Gilroy	Residential	5/9/2016	68	70
N125	111 Martin Street, Gilroy	Residential	10/20/2010	58	65
N126	7250 Alexander Street, Gilroy	Residential	2/14/2017	59	64
N129	1230 Bloomfield, Gilroy	Residential	5/3/2016	71	74
N130	8247 Lovers Lane, Hollister	Residential	5/6/2016	61	66
US 101 through Morgan Hill					
N102	(adjacent to) 19490 Vista De Lomas, Morgan Hill	Residential	5/9/2016	69	67
N105	17905 Condit, Morgan Hill	Residential	5/13/2016	66	68
N107	877 English Walnut Court, Morgan Hill	Residential	10/19/2010	69	69
N109	15450 Murphy Avenue, Morgan Hill	Residential	10/18/2010	57	60
N110	14916 Llagas Avenue, Morgan Hill	Residential	12/19/2016	70	68
N112	14150 Murphy Avenue, San Martin	Residential	10/18/2010	62	62
East Gilroy					
N116	11460 Rothe Avenue, Gilroy	Residential	10/20/2010	56	59
N117	405 Lena Avenue, Gilroy	Residential	10/21/2010	62	58
N119	695 Rucker Avenue, Gilroy	Residential	5/6/2016	68	69
N123	8415 Marcella Avenue, Gilroy	Residential	12/19/2016	66	65
N127	6780 Holsclaw Road, Gilroy	Residential	5/6/2016	67	66
N128	1975 CA-152, Gilroy	Residential	2/14/2017	82	79
Pacheco Pass Subsection					
N131	210 Walnut Avenue, Hollister	Residential	11/17/2010	58	54
N132	Pacheco Pass Highway	Residential	5/13/2016	82	79
San Joaquin Valley Subsection					
N133	28263 Fahey Road, Los Banos	Residential	5/20/2016	65	67
N134	(adjacent to) 24334 Henry Miller Avenue, Los Banos	Residential	5/20/2016	74	72
N135	(adjacent to) 21534 Henry Miller Avenue, Los Banos	Residential	5/20/2016	79	79
N136	(adjacent to) 18827 Henry Miller Road, Los Banos	Residential	5/20/2016	73	72
N137	13893 Henry Miller Road, Los Banos	Residential	11/15/2010	65	67
N138	12051 Carlucci Road, Los Banos	Residential	5/20/2016	67	71

Sources: Authority 2011; Authority and FRA 2014; Wilson Ihrig 2014

[1] The L_{dn} was calculated from the average hourly L_{eq} values collected over the entire measurement period.

[2] Includes existing noise from nearby airport.

dBA = A-weighted decibel

L_{dn} = day-night sound level

L_{eq} = equivalent sound level, dBA

US = U.S. Highway

San Jose Diridon Station Approach Subsection

In San Jose, the noise RSA follows the Caltrain right-of-way through moderately dense urban areas with mixed land use. The ambient L_{dn} in the San Jose Diridon Station Approach Subsection ranges from 61 dBA to 82 dBA.

North of San Jose Diridon Station, the land use on the east side of the existing rail alignment is primarily industrial, while the western side is mainly residential. The closest residence is approximately 50 feet from the existing railway line. Bellarmine College Preparatory School campus is on the western side of the RSA. The closest Bellarmine school buildings are more than 350 feet from the existing railway line.[6] At San Jose Diridon Station, there are multifamily buildings along the entire west side of the station facing the existing tracks and platforms. Templo La Hermosa church is on the eastern side of the station, beyond the parking lots approximately 550 feet from the station.

South of San Jose Diridon Station, land uses in the noise RSA include transportation rights-of-way associated with Interstate (I-) 280 and State Route (SR) 87, residential neighborhoods, and some commercial/industrial areas. The San Jose Fire Department Bureau of Field Operations campus is just south of San Jose Diridon Station on the east side of the RSA.[7] Gardner Elementary School is approximately 275 feet south of I-280 on the south side of the RSA.

In this subsection, the alignment is in a heavily used rail corridor with 92 daily weekday Caltrain passenger trains currently operating between San Francisco and San Jose Diridon Station, and 40 daily Caltrain trains operating between San Jose Diridon Station and Tamien Station. Between two and nine freight trains run along the route per day. Fourteen Capital Corridor and eight Altamont Corridor Express (ACE) trains run along the alignment daily between De La Cruz Boulevard and San Jose Diridon Station. ACE trains continue to travel south to Tamien Station to access the layover facility. Amtrak Coast Starlight trains pass through this subsection twice daily. Santa Clara Valley Transportation Authority (VTA) light rail trains run along the center of SR 87. Other noise sources include traffic on I-880, SR 87, I-280, local roads, as well as aircraft activities associated with Norman Y. Mineta San Jose International Airport.

Monterey Corridor Subsection

The ambient L_{dn} in the Monterey Corridor Subsection ranges from 61 dBA to 79 dBA. South of West Alma Avenue, the noise RSA extends along SR 87 until south of Almaden Expressway, where it turns east toward Monterey Road following the UPRR right-of-way. Land uses along the Monterey Corridor Subsection include primarily single-family residential neighborhoods and some commercial/industrial areas. Toward the southern end of the subsection, land uses include scattered single-family homes and farms.

The closest residence is approximately 30 feet from the existing railway line, near Skyway Drive, where backyards of single-family homes abut the right-of-way. An Elk's Lodge on West Alma Avenue is approximately 180 feet from SR 87 on the west side of the RSA. On the east side of the RSA near West Alma Avenue, a recording studio is approximately 350 feet from the existing railway and behind some intervening commercial buildings. The School of the Blues music school is on Monterey Road, approximately 190 feet from the existing railway line. Other institutional land uses include Edenvale Branch Library and four places of worship.

[6] Outdoor sports fields associated with Bellarmine College Preparatory School are located adjacent to the existing railway line, but are not considered noise-sensitive uses by the FRA guidance manual (FRA 2012).

[7] Fire stations contain sleeping accommodations and are considered sensitive noise receptors at all times of day and night.

Sources of existing noise include traffic on SR 87, Monterey Road (near Capitol Caltrain Station), SR 85, and local roads, as well as the existing rail traffic. South of Tamien Station, the daily rail traffic consists of six Caltrain passenger trains, two Amtrak passenger trains, and approximately four freight trains per day. Santa Clara VTA light rail trains also run along the center of SR 87.

Morgan Hill and Gilroy Subsection

In this subsection, the noise RSA diverges to follow the different project alignments.

Along Monterey Road through Downtown Gilroy

The ambient L_{dn} along this portion of the Morgan Hill and Gilroy Subsection ranges from 56 dBA to 81 dBA, depending on the location. The noise RSA extends along the single UPRR track from Bernal Way into downtown Gilroy. It continues past the Gilroy Caltrain Station, along UPRR south of downtown, and then turns east toward the Pacheco Pass Highway near Bloomfield Avenue. Land uses include farms with scattered single-family homes, and residential neighborhoods and commercial areas in Morgan Hill and San Martin. In south San Jose between Bernal Way and Metcalf Road, the closest residences to the existing railway line are a row of single-family homes approximately 40 feet away with backyards abutting the right-of-way. Three hotels are within 200 feet of the existing railway line. The closest school is approximately 145 feet from the existing railway line. The closest place of worship is approximately 150 feet from the existing railway line. In downtown Morgan Hill, the Morgan Hill Community Center outdoor amphitheater is approximately 500 feet from the existing railway line and the South Valley Civic Theatre and Community Playhouse is more than 600 feet from the railway line.

In the downtown Gilroy area, land uses include a mix of residential neighborhoods and commercial/industrial areas. South of downtown, land uses include farms with scattered single-family homes. The closest residential building to the existing railway line is approximately 50 feet from UPRR track on Monterey Road and Lewis Street. The closest school is Gilroy Preparatory School, which is approximately 145 feet from the existing railway line. Pintello Comedy Theater is approximately 365 feet from the existing railway line and the District Theater Live Music Venue is 50 feet from the railway line.

Sources of existing noise include traffic on Monterey Road and local roads, as well as the rail traffic along UPRR consisting of six Caltrain passenger trains, two Amtrak passenger trains, and approximately four freight trains per day. Caltrain trains stop at the existing Gilroy station, which is a terminal station. Amtrak and freight trains continue to operate south of Gilroy. Farming and industrial activities south of Metcalf Road also contribute to existing noise levels, as do aircraft activities associated with South County Airport and Frazier Lake Airpark.

Adjacent to US 101 through Morgan Hill

The ambient L_{dn} along this portion of the Morgan Hill and Gilroy Subsection ranged from 57 dBA to 70 dBA. Land uses include farms with scattered single-family homes, and residential neighborhoods and commercial areas in Morgan Hill near El Camino Real/U.S. Highway (US) 101. For most of this noise RSA, the noise environment is dominated by US 101 and local street traffic. At connection points on both ends, some receptors are exposed to the rail traffic along UPRR (six Caltrain passenger trains, two Amtrak passenger trains, and approximately four freight trains per day). Farming activities south of Morgan Hill also contribute to existing noise levels.

East Gilroy

The ambient L_{dn} along this portion of the Morgan Hill and Gilroy Subsection ranged from 56 dBA to 82 dBA. Land uses include farms with scattered single-family homes. For most of this RSA, rural traffic dominates the noise environment. At the connection point, some receptors are exposed to the rail traffic along UPRR (six Caltrain passenger trains, two Amtrak passenger trains, and approximately four freight trains per day). Other noise sources include aircraft activities associated with Frazier Lake Airpark and farming activities.

Pacheco Pass Subsection

The ambient L_{dn} along this subsection ranges from 58 dBA to 82 dBA. Land uses in this subsection are quite different from the rest of the project extent. Most of the RSA consists of open spaces, including the Cottonwood Creek Wildlife Area, with some scattered single-family residences. The noise environment is dominated by SR 152 and rural traffic. Most of the alignment in this subsection is in a tunnel.

San Joaquin Valley Subsection

The ambient L_{dn} along this subsection ranges from 65 dBA to 79 dBA. The RSA passes Santa Nella Road/I-5 then follows Henry Miller Road to Carlucci Road. Land uses include farms with scattered single-family homes and one elementary school. For most of the San Joaquin Valley Subsection, there are no existing rail noise sources and rural traffic dominates the noise environment. In Volta, a freight railroad line crosses the RSA. One single-family residence is within 200 feet of the freight railway line. Sources of existing noise include traffic along Henry Miller Road and other local roadways as well as farming activities.

Noise Measurement and Modeling Discussion

To validate the existing noise model, analysts compared the existing noise spreadsheet model results to the measured noise levels at the locations of the noise monitors. The comparison of the existing noise model results to the measured noise levels at the measurement locations (Volume 2, Appendix 3.4-A) indicate that the existing noise model is in close agreement with the field noise measurement data. Analysts used the existing noise model to predict ambient noise levels at all sensitive receptors, typically at the building facades, in the RSA.

3.4.5.2 Vibration

This section summarizes the locations and results of vibration measurements by project subsection. It also describes the vibration-sensitive land uses and sources of existing vibration in the RSA.

Vibration Measurement Results

Analysts conducted measurements of the existing vibration levels associated with train passbys at 14 sites in the RSA. These measurements were made in the vertical direction. Table 3.4-12 shows the results of the existing vibration measurements conducted between 2009 and 2016, which are organized by subsection.[8] The locations of the vibration measurement sites are illustrated in Volume 2, Appendix 3.4-A. At each site, ground-borne vibration levels were recorded at multiple distances from the tracks. These distances from the track centerline where the vibration levels were measured are reported in Table 3.4-12. The results include the range of maximum overall ground-borne vibration levels for each type of train passby based on distance from the track. Higher vibration levels occur closer to the existing tracks and the vibration levels decrease with distance from the track.

[8] The vibration analysis includes vibration measurements conducted in 2009 and 2010 by the Authority's contractors for unpublished noise and vibration technical studies; vibration measurements conducted in 2013 that are included in the *Caltrain Peninsula Corridor Electrification Project Noise and Vibration Technical Report* (Wilson Ihrig 2014); and vibration measurements conducted in 2016 as part of this assessment.

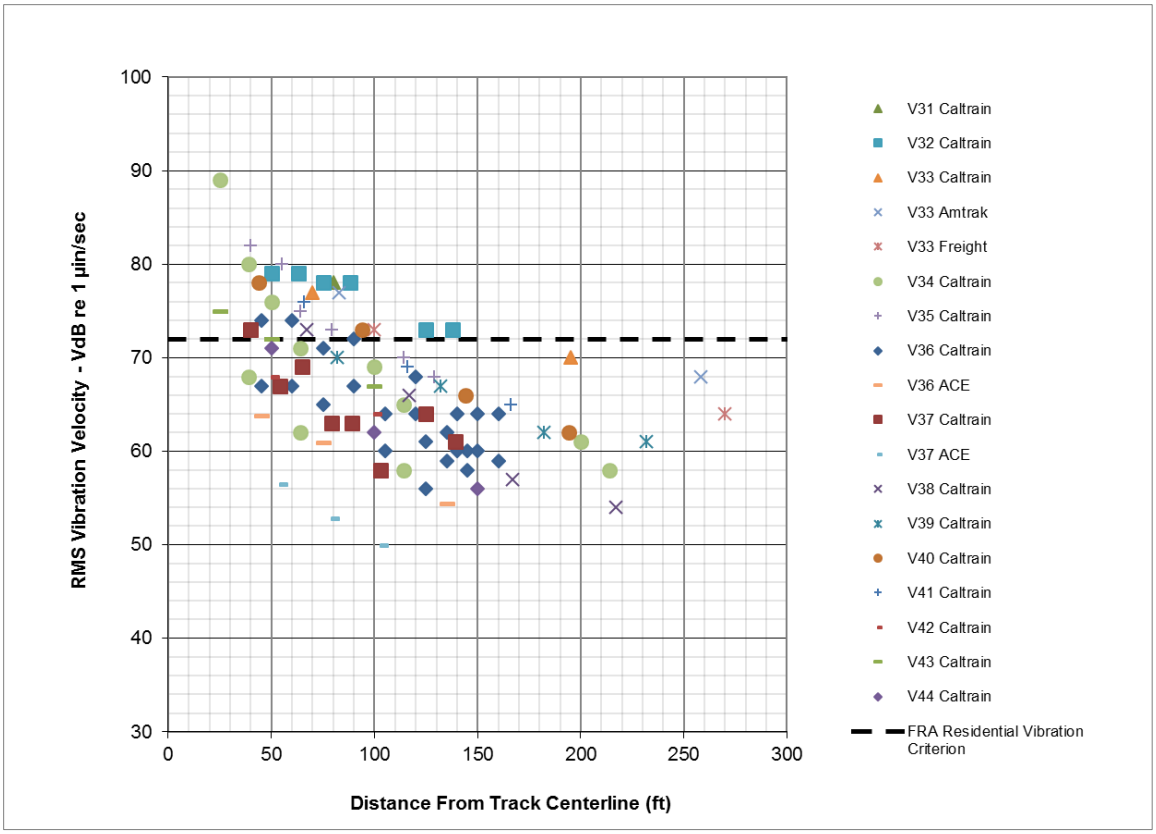
Table 3.4-12 Existing Vibration Measurement Locations

Site	Location	Date	Distance from track (feet)	Overall Vibration Level (VdB)	Source
San Jose Diridon Station Approach Subsection					
V31	2075 Main Street, Santa Clara	10/20/2009	80 – 125	78 – 73	Caltrain
V32	890 Newhall Street, San Jose	7/1/2016	50 – 138	79 – 73	Caltrain
V33	855 McKendrie Street, San Jose	3/10/2010	70 – 195	77 – 70	Caltrain
			83 – 258	77 – 68	Amtrak
			100 – 270	73 – 64	Freight
V34	782 Auzerais Avenue, San Jose	5/29/2013	25 – 214	89 – 58	Caltrain
V35	704 Harrison Street, San Jose	7/1/2016	40 – 114	83 – 70	Caltrain
V36	Jerome Street & Willis Avenue, San Jose	7/28/2016	105 – 160	68 – 56	Caltrain
			45 – 150	74 – 59	Caltrain
			45 – 135	64 – 54	ACE
V37	Fuller Avenue & Delmas Avenue, San Jose	5/31/2016	40 – 139	73 – 58	Caltrain
			54 – 103	56 – 50	ACE
Monterey Corridor Subsection					
V38	Pomme Court & Olive Hill Drive, San Jose	6/01/2016	67 – 217	73 – 54	Caltrain
V39	Hayes Avenue & Endicott Boulevard, San Jose	5/17/2016	82 – 232	70 – 61	Caltrain
Morgan Hill and Gilroy Subsection					
V40	Old Monterey Road & Paloma Drive, Morgan Hill	5/18/2016	44 – 194	78 – 62	Caltrain
V41	East Middle Avenue & Crowner Avenue, San Martin	5/18/2016	66 – 166	76 – 65	Caltrain
V42	Depot Street & North Street, San Martin	7/21/2016	25 – 100	75 – 64	Caltrain
V43	Depot Street & South Street, San Martin	7/21/2016	25 – 100	75 – 67	Caltrain
V44	Railroad Street & Lewis Street, Gilroy	5/18/2016	50 – 150	71 – 56	Caltrain

VdB = vibration decibels
ACE = Altamont Corridor Express

Figure 3.4-7 illustrates the general attenuation with distance and the range of measured vibration (Volume 2, Appendix 3.4-A, provides more details).

FRA notes that typical outdoor sources of perceptible ground-borne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If the roadway is smooth, the vibration from traffic is rarely perceptible (FRA 2012). For most of the project, the dominant existing vibration source is train traffic. Vibration from traffic is only mentioned if the levels are comparable to 72 VdB. In subsections where the vibration RSA diverges from the existing railroad right-of-way, there are no significant existing sources of vibration. The vibration-sensitive land uses in the RSA are generally located where the vibration RSA is adjacent to existing rail rights-of-way and, therefore, where analysts conducted existing ambient vibration measurements.



FEBRUARY 2019

Figure 3.4-7 Existing Vibration Measurement Levels

The measurements show that the vibration levels decrease with distance, which varies at each site as a function of distance from the track, the train type, and train speed. At most sites, the overall vibration levels exceeded the FRA residential criterion at locations less than 50 feet from the track and at some sites up to approximately 100 feet from the track.

As discussed in Section 3.4.4.3, Methods for Impact Analysis, analysts also conducted vibration propagation measurements at 10 locations to assist in the prediction of ground-borne vibration levels from project operations. The vibration propagation measurements are site-specific tests that quantify the efficiency of vibration propagation through the soil at specific locations. One borehole vibration propagation test was also conducted in the RSA during previous work in 2010. Volume 2, Appendix 3.4-A, and Table 3.4-13 shows the vibration propagation measurement locations.

Table 3.4-13 Vibration Propagation Measurement Locations

Site	Location	Date	Test Type	Depth (feet)[1]
San Jose Diridon Station Approach				
VP19	Main Street & Washington Street, Santa Clara	3/25/2010	Borehole	50, 60, 70
VP20	855 McKendrie Street, San Jose	3/10/2010	Surface	0
VP21	Jerome Street & Willis Avenue, San Jose	7/28/2016	Surface	0
Monterey Corridor Subsection				
VP22	Hayes Avenue & Endicott Boulevard, San Jose	5/17/2016	Surface	0
Morgan Hill and Gilroy				
VP23	Old Monterey Road & Paloma Drive, Morgan Hill	5/18/2016	Surface	0
VP24	Seymour Avenue & East Middle Avenue, San Martin	7/22/2016	Surface	0
VP25	Depot Street & North Avenue, San Martin	7/21/2016	Surface	0
VP26	Depot Street & Spring Street, San Martin	5/18/2016	Surface	0
VP27	Alexander Street & East Eighth Street, Gilroy	5/19/2016	Surface	0
Pacheco Pass				
	N/A[2]			
San Joaquin Valley				
VP28	Volta Road & Henry Miller Road, Los Banos	5/24/2016	Surface	0

[1] At site # VP19, vibration propagation was measured at multiple borehole depths.
[2] No vibration propagation measurements were conducted in the Pacheco Pass Subsection because no sensitive receptors are near the project.
N/A = not applicable

San Jose Diridon Station Approach Subsection

The sensitive land uses in the vibration RSA in this subsection are the same as those described in the noise RSA for this subsection. Existing vibration in this portion of the RSA is dominated by a number of existing rail operations that share the alignment. This alignment is a heavily used rail corridor with 92 daily weekday Caltrain passenger trains currently operating between San Francisco and San Jose Diridon Station. Forty daily Caltrain trains operate through to Tamien Station. Approximately two to nine freight trains run along the route per day. Fourteen Capital Corridor and eight ACE trains run along the alignment daily between De La Cruz Boulevard and San Jose Diridon Station. ACE trains continue to travel south to Tamien Station to access the layover facility. Amtrak Coast Starlight trains pass through the section twice daily. Santa Clara VTA light rail trains run along the center of SR 87.

Vibration from Caltrain trains was measured at three sites north of San Jose Diridon Station. Overall ground-borne vibration levels from Caltrain measured at the closest positions ranged from 79 VdB to 78 VdB at 50 and 80 feet, respectively, from the tracks. The vibration levels from Amtrak trains measured at McKendrie Street in San Jose were similar to Caltrain trains. Vibration levels from freight train operations measured at this site ranged from 73 VdB (at 100 feet) to 64 VdB (at 270 feet).

Vibration from Caltrain trains was measured at three sites south of San Jose Diridon Station. Overall vibration levels from Caltrain at the closest positions ranged from 83 VdB (at 40 feet) to 68 VdB (at 105 feet). Vibration levels from ACE trains at Jerome Street and Willis Avenue were lower than Caltrain trains.

Monterey Corridor Subsection

Sources of existing vibration include traffic on SR 87 and Monterey Road, as well as the existing rail traffic along UPRR. South of the Tamien Station, the daily rail traffic consists of six Caltrain passenger trains, two Amtrak trains, and approximately four freight trains per day. VTA light rail also runs along the center of SR 87.

Vibration from Caltrain trains was measured at Pomme Court and Olive Hill Drive in San Jose. Overall vibration levels from Caltrain ranged from 73 VdB (at 67 feet) to 54 VdB (at 217 feet) from the tracks. Vibration from Caltrain trains was also measured at Hayes Avenue and Endicott Boulevard in San Jose. Overall vibration levels ranged from 70 VdB to 61 VdB at 82 feet and 232 feet, respectively, from the tracks.

Morgan Hill and Gilroy Subsection

Along Monterey Road through Downtown Gilroy

Sources of existing vibration include existing rail traffic along UPRR (six Caltrain passenger trains, two Amtrak passenger trains, and approximately four freight trains per day). Caltrain trains stop at the existing Gilroy station, which is where Caltrain service terminates. Amtrak and freight trains continue to operate south of Gilroy.

Analysts measured vibrations from Caltrain trains at five sites from Morgan Hill to Gilroy. Overall ground-borne vibration levels from Caltrain measured at the closest positions ranged from 78 VdB at 44 feet to 71 VdB at 50 feet from the tracks. Levels at the farthest measured distances ranged from 67 VdB (at 100 feet) to 56 VdB (at 150 feet).

Adjacent to US 101 through Morgan Hill

For most of this RSA, there are no existing rail vibration sources and the existing low-level vibration environment is primarily caused by traffic on US 101 and local streets. At connection points on both ends, some receptors are exposed to the existing rail traffic along UPRR (Caltrain passenger trains, two Amtrak passenger trains, and approximately four freight trains per day).

East Gilroy

For most of this RSA, there are no existing rail vibration sources and the existing low-level vibration environment is primarily from traffic on rural streets. At the connection point, some receptors are exposed to the existing rail traffic along UPRR (Caltrain passenger trains, two Amtrak passenger trains, and approximately four freight trains per day).

Pacheco Pass Subsection

For most of this RSA, there are no existing rail vibration sources and the existing low-level vibration environment is primarily from traffic on SR 152 and rural streets. The RSA passes through two portions of the Cottonwood Creek Wildlife Area, which is an outdoor land use. Vibration impact criteria have not been established for animals. Therefore, analysts conducted no vibration propagation measurements in the Pacheco Pass Subsection.

San Joaquin Valley Subsection

The vibration RSA passes Santa Nella Road/I-5 then follows Henry Miller Road to Carlucci Road. Land uses include farms with scattered single-family homes and one elementary school. For most of the San Joaquin Valley Subsection, there are no existing rail vibration sources and the existing low-level vibration environment is primarily from traffic on rural streets. In Volta, a freight railroad line crosses the RSA. One single-family residence is within 200 feet of the existing freight railway line and the RSA.

3.4.6 Environmental Consequences

3.4.6.1 Overview

This section discusses the potential noise and vibration impacts of project construction and operations on sensitive receptors and structures. The analysis evaluates construction noise and vibration, and noise and vibration associated with train operations, passenger stations, MOWFs, and traction power facilities under the 2029 No Project, 2029 Plus Project, 2040 No Project, and

2040 Plus Project conditions. It also evaluates the potential for human annoyance from the rapid onset of noise from HSR passbys, indirect noise impacts associated with changes in vehicular traffic as a result of project operations, and the potential for noise impacts on livestock near the right-of-way.

The evaluation of vibration impacts focuses on the temporary exposure of sensitive receptors and buildings to construction-related vibration, temporary and permanent exposure of buildings to construction-related vibration damage, and the permanent exposures of sensitive receptors to vibration associated with project operations.

The Authority incorporated an IAMF (NV-IAMF#1) into the project to minimize construction-related noise and vibration impacts. The IAMF will require the contractor to prepare and submit to the Authority prior to construction a noise and vibration technical memorandum documenting how the FTA and FRA guidelines for minimizing construction noise and vibration impacts will be employed when work is conducted within 1,000 feet of sensitive receptors. This IAMF is described in detail in Volume 2, Appendix 2-E, Project Impact Avoidance and Minimization Measures.

3.4.6.2 Noise

Construction and operations of the project alternatives would result in temporary and permanent impacts from noise. At any one receptor, construction activities would occur over the course of a few days to up to 2 or 4 weeks for many project activities, such as utility relocation, grading, excavation, minor trackwork, demolition, and installation of four-quadrant gates and perimeter fencing. Some activities would occur for a longer period of time, such as construction of new tracks and stations. All these activities would temporarily increase noise levels. Project operations would increase noise levels due to operations of HSR trains, station noise from HSR train movement and parking, MOWF noise, and noise from changes in vehicle traffic patterns.

No Project Conditions

The San Francisco Bay Area (Bay Area) and San Joaquin Valley populations are expected to grow through 2040 (Section 2.6.1.1, Projections Used in Planning), with the San Joaquin Valley population projected to grow at a higher rate than any other region in California. Development in the Bay Area and San Joaquin Valley to accommodate the population increase would continue under the No Project Alternative and result in associated direct and indirect impacts. The No Project Alternative considers the impacts of conditions forecasted by current land use and transportation plans in the project vicinity, including planned improvements to the highway, aviation, conventional passenger rail, freight rail, and port systems through the 2040 planning horizon. Without the project, the forecasted population growth would increase pressure to expand highway and airport capacities. The Authority estimates that additional highway and airport projects (up to 4,300 highway lane miles, 115 airport gates, and 4 airport runways) would be needed to achieve equivalent capacity and relieve the increased pressure (Authority 2012b). Planned and other reasonably foreseeable projects anticipated to be built by 2040 include residential, commercial, industrial, recreational, and transportation projects. A full list of anticipated future development projects is provided in Volume 2 in Appendix 3.18-A, Cumulative Plans and Nontransportation Projects List, and Appendix 3.18-B, Cumulative Transportation Projects List.

As described in Section 3.4.5, Affected Environment, much of the RSA currently experiences noise from passenger and freight rail traffic as well as roadway traffic. Highway improvement projects, such as the widening of US 101 and SR 152, as well as new or expanded residential and commercial developments would increase existing traffic levels and associated noise in the RSA. An increase in freight and passenger train movement to accommodate growth and the introduction of several new planned passenger rail services in the RSA—the Coast Daylight, the Transportation Agency for Monterey County Salinas Rail Extension, and the Bay Area Rapid Transit (BART) Silicon Valley Santa Clara Extension—would further increase transportation noise in the RSA (see Volume 2, Appendix 3.4-A for daily train operations under existing conditions, as well as the 2029 and 2040 No Project train operations). The approved Caltrain PCEP would electrify the Caltrain Corridor between San Francisco and the Tamien Station in San Jose,

convert approximately 75 percent of diesel locomotive-hauled coaches to EMUs, and increase service to six trains per peak hour per direction under the No Project Alternative between San Jose and San Francisco (but would not change service levels between Gilroy and San Jose). Overall, increases in noise levels under the No Project Alternative are not anticipated to exceed 3 dBA, which would only occur with a doubling of all current freeway and rail traffic.

Planned development and transportation projects that would occur as part of the No Project Alternative would likely include project features and mitigation to reduce impacts on noise. Future developments planned under the No Project Alternative would require individual environmental review, including an analysis of noise impacts on sensitive receptors, which would be analyzed under state and federal highway noise criteria. Any increases in noise would be regulated by local general plans and noise and vibration ordinances. It would be the responsibility of the affected jurisdiction to establish consistency with local regulations and ordinances aimed at avoiding or reducing permanent increases in noise levels.

Project Impacts

Construction Impacts

Project construction would involve demolition of existing structures; clearing and grubbing; handling, storing, hauling, excavating, and placing fill; pile driving; and construction of aerial structures, bridges, road modifications, utility upgrades and relocations, HSR electrical systems, and railbeds. Section 2.11, Construction Plan, describes construction activities.

Impact NV#1: Temporary Exposure of Sensitive Receptors to Construction Noise

The project would include construction of new tracks and stations, utility relocation, grading, excavation, trackwork, demolition, and installation of systems components. Some of these construction activities would occur in residential areas and at other noise-sensitive land uses within several hundred feet of the alignment. The potential for noise impacts would be greatest near pavement breaking and close to nighttime construction work. Construction noise varies with the process used, layout of the sites, and the type and condition of the equipment used. The noisiest pieces of equipment determine the maximum sound levels from construction activities.

Temporary noise impacts would result from activities associated with construction, modification, and relocation of existing tracks, stations, and platforms; modification of existing roadways and structures; construction of the MOWF; construction of new tracks and viaduct installation of four-quadrant gates at the at-grade crossings and perimeter fencing at the edge of the right-of-way; utility relocation; site preparation including demolition, excavation, and grading; and installation of systems components. Construction noise varies with the construction method, layout of the sites, and the type and condition of the equipment used. The noisiest pieces of equipment determine the maximum sound levels from construction activities, which are evaluated on an L_{eq} basis over an 8-hour construction period.

The duration and intensity of construction activities would vary by location and project component. Minor track shifts within the existing Caltrain corridor (Alternative 4) would be performed by “on-track” equipment that would operate along the existing Caltrain tracks as it adjusts track alignment and ballast; this would be expected to last no more than several days at any given location. Generally, about 600 feet of trackwork would be completed within a few days. Installing four-quadrant gates at existing at-grade crossings would occur over a period of 2 to 4 weeks; radio towers would take 3 to 6 months. The construction of several major project components would, however, occur over several years—expanding the existing San Jose Diridon Station would take approximately 2 years, while the aerial San Jose Diridon Station under Alternative 1, 2, and 3 would take 3 to 4 years. Building the MOWF would take 1 year.

While most of these construction activities would occur mostly within the right-of-way and primarily during daytime hours during the week, work at turnouts, temporary passing tracks, track and overhead contact system pole relocation, and some roadway realignments would require weekend and nighttime construction work. Track realignments of less than 10 feet would be done at night or on weekends, and speed restrictions would be imposed until the track realignment is

completed. For realignments of more than 10 feet, a parallel track would be built first and then connected to the existing track. Temporary track closure for reconnecting tracks would occur at night or on weekends and would have a duration of 1 to 2 days each. There might also be temporary nighttime construction work associated with the modification of underpasses in the vicinity of the passing tracks.

The potential for noise impacts would be greatest where noise-sensitive land uses are near major construction activities with a long duration (e.g., MOWF, passing tracks, viaduct, station modifications) and nighttime construction activities (e.g., temporary passing tracks, parallel tracks, and roadway realignment).

The alternatives include project features (IAMFs) to avoid or minimize potential impacts from construction and operations. NV-IAMF#1 will require the contractor to prepare and submit to the Authority prior to construction a noise and vibration technical memorandum documenting how the FRA guidelines for minimizing construction noise and vibration impacts will be employed when work is being conducted within 1,000 feet of sensitive receptors. Typical construction practices contained in the FRA guidance manual (FRA 2012) for minimizing construction noise and vibration impacts include the following:

- Build noise barriers, such as temporary walls or piles on excavated material, between noisy activities and noise-sensitive resources.
- Route truck traffic away from residential streets where possible.
- Build walled enclosures around especially noisy activities or around clusters of noisy equipment.
- Combine noisy operations so that they occur in the same period.
- Phase demolition, earthmoving, and ground-impacting operations so as not to occur in the same period.
- Avoid impact pile driving where possible in vibration-sensitive areas.

Application of the FRA guidelines would minimize temporary construction impacts on sensitive receptors. However, based on the analysis summarized below, there is still the potential for adverse impacts from construction noise where sensitive receptors are within 774 feet of HSR nighttime construction activity or are within 245 feet of HSR daytime construction activity.

Table 3.4-14 shows key differences among the project alternatives that would determine how construction noise affects the communities.

Table 3.4-14 Differences among Alternatives

Subsection	Alternative 1	Alternative 2	Alternative 3	Alternative 4
San Jose Diridon Station Approach	Aerial/interchange touchdown at I-880	Aerial/interchange touchdown at Scott	Same as Alternative 2	At grade, right-of-way blended
Monterey Corridor	Aerial	Embankment	Aerial	At grade, right-of-way blended
Morgan Hill and Gilroy	Aerial	Embankment/ at grade	Far east aerial would avoid downtown Gilroy and Morgan Hill	At grade, right-of-way blended
Pacheco Pass	Mostly tunnel			
San Joaquin Valley	Aerial/embankment			

Source: Authority 2019a

Analysts identified five typical types of construction activities that would be used during project construction and evaluated the noisiest pieces of equipment required for each activity. Applying the typical maximum sound levels of each piece of equipment and its utilization factor, analysts calculated the total 8-hour L_{eq} and the distance at which the L_{eq} would reach the noise impact criteria shown in Table 3.4-4.

Table 3.4-15 shows the result of this analysis. For typical track construction scenarios, the residential nighttime 8-hour L_{eq} criterion of 70 dBA would potentially be exceeded up to 374 feet from the clear-and-grub construction activity, and as far away as 774 feet from the concrete pour aerial structure activity. For the PG&E upgrade construction scenarios, the residential nighttime 8-hour L_{eq} criterion of 70 dBA would be exceeded up to 158 feet from the haul material construction activity and as far away as 522 feet from the conductor installation construction activity. These distances identified in Table 3.4-15 would be applicable to all four project alternatives because the same types and duration of construction activities would apply to all four alternatives.

Table 3.4-15 Construction Activity Noise Levels

Construction Activity	Equipment Type	Total 8-Hour L_{eq} (dBA) at 50 feet	Distance to 70 dBA[1] Residential Nighttime Criterion (feet)	Distance to 80 dBA[1] Residential Daytime Criterion (feet)	Distance to 85 dBA[1] Commercial Criterion (feet)	Distance to 90 dBA[1] Industrial Criterion (feet)
Track Construction						
Clear and grub	Dump truck, water truck, rubber-tired dozer, loader, crane	87	374	118	66	37
Grading	Scraper, grader, crushing equipment, dump truck, rubber-tired dozer, excavator, loader, water truck	90	515	163	92	51
Concrete pour aerial structure	Transit mix truck, crane, drill rig, dump truck, flatbed truck, loader, forklift, pump, water truck	94	774	245	138	77
Ballast compaction	Loader, crushing equipment, water truck, dump truck	89	425	134	76	42
Track installation	Crushing equipment, plate compactor, dump truck, grader, scraper, water truck	91	585	185	104	59
PG&E Network Upgrades Construction						
Site preparation	Backhoe, small bulldozer, truck with trailer, water truck, light-duty pickup truck, sweeper/scrubber, plate compactor, motor grader	87	362	114	64	36

Construction Activity	Equipment Type	Total 8-Hour L_{eq} (dBA) at 50 feet	Distance to 70 dBA[1] Residential Nighttime Criterion (feet)	Distance to 80 dBA[1] Residential Daytime Criterion (feet)	Distance to 85 dBA[1] Commercial Criterion (feet)	Distance to 90 dBA[1] Industrial Criterion (feet)
Auger holes	Water truck, pickup truck, line truck with auger attachment	82	202	64	36	20
Haul material	Line truck with trailer	80	158	50	28	16
Tower installation	Crane, helicopter, vacuum trailer, rough terrain forklift, pump, bucket truck	90	483	153	86	48
Conductor installation	Line truck with reel, pickup trucks, line truck with bucket/crane, line truck with conductor puller, line truck with conductor tensioner, helicopter, cement and mortar mixer, dump truck	90	522	165	93	52

[1] Distances for this analysis assume that all pieces of equipment are at the center of the construction site.
L_{eq} = equivalent sound level
dBA = A-weighted decibel
PG&E = Pacific Gas and Electric

As described in Section 3.4.5.1, Noise, sensitive receptors are close to the project alignment in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections. The closest residential sensitive receptors in these subsections are within 30 to 40 feet of the right-of-way, well within the distances where exceedances of the FRA noise guidelines would occur for typical track construction activities. Sensitive receptors located closer to the construction activities than the distances reported in Table 3.4-15 would experience temporary increases in noise levels in exceedance of the FRA noise impact criteria for a duration of up to 1.5 years at any given location. The amount of construction effort for the design variants would be approximately the same as the alternatives without the DDV and TDV and thus construction generation of noise would be approximately the same. However, the DDV would be constructed closer to a few sensitive receptors east of the construction area north of the SAP Center. The TDV is in the same location as the alternatives without the TDV and thus would not change construction noise effects on any receptors.

For the Monterey Corridor and Morgan Hill and Gilroy Subsections, construction of the viaduct structure (Alternatives 1 and 3) would have a larger criterion distance than the embankment and at-grade track options (Alternatives 2 and 4, respectively) because of the height of the structure and the concrete pumps. For the San Jose Diridon Approach Subsection, the aerial viaduct (Alternatives 1, 2, and 3) would similarly have a larger criterion distance than Alternative 4. Nighttime construction would be required under Alternative 4 to minimize disruption of existing passenger rail services.

CEQA Conclusion

The impact under CEQA would be significant for all four project alternatives, with and without the DDV and TDV, because project construction would temporarily and substantially increase ambient noise levels in the noise RSA above levels without project construction, and the noise increase would be in exceedance of FRA guidelines for some receptors proximate to the construction activities—for example, at residences the criteria is 70 dBA for nighttime construction and 80 dBA for daytime construction. The alternatives would incorporate NV-IAMF#1 to minimize

noise impacts by requiring compliance with FRA guidelines for minimizing construction noise and vibration impacts when work is conducted within 1,000 feet of sensitive receptors. However, even with NV-IAMF#1, some sensitive receptors will be exposed to construction noise levels that exceed FRA guidelines. Under Alternative 4 with the DDV, there may be a few additional receptors that may be subject to such unavoidable effects under CEQA during construction. Mitigation to address this impact is identified in Section 3.4.9, CEQA Significance Conclusions. Section 3.4.7, Mitigation Measures, describes the mitigation in detail.

Operations Impacts

Project operations would involve scheduled train travel along the HSR tracks through the RSA between stations and to and from the MOWF near Gilroy. Operations would generate additional traffic volumes near the stations and maintenance facilities associated with passengers and employees.

Impact NV#2: Intermittent Permanent Exposure of Sensitive Receptors to Noise from Train Operations

Under the 2029 and 2040 No Project conditions, changes in noise levels would be associated with the Caltrain PCEP. The 2029 and 2040 Plus Project conditions evaluate changes in noise associated with combined implementation of the Caltrain PCEP and the project.

Table 3.4-16 shows the results of 2029 No Project and 2029 Plus Project conditions noise impact assessments. The total number of noise sensitive receptors (e.g., residence, hospital, or school) that would result in a noise impact are listed in each column. Alternative 1 would result in 47 severe impacts and 310 moderate impacts, Alternative 2 would result in 38 severe impacts and 599 moderate impacts,[9] Alternative 3 would result in 34 severe impacts and 227 moderate impacts, and Alternative 4 would result in 190 severe impacts and 1,001 moderate impacts. Alternative 4 would have the most severe and moderate operations noise impacts, followed by Alternative 2, Alternative 1, and Alternative 3. Noise impacts, before mitigation, associated with the DDV (which applies only to Alternative 4 in the San Jose Diridon Station Approach Subsection) and the TDV (which applies to all alternatives within the Morgan Hill and Gilroy, Pacheco Pass, and San Joaquin Valley Subsections[10]) are shown in parentheses in Table 3.4-16. In some cases, new receptors would have moderate or severe noise impacts with the DDV and TDV. In some cases, receptors that would not have moderate or severe noise impacts without the DDV and TDV would have moderate or severe impacts with the DDV and TDV. In some cases, receptors that would have moderate noise impacts without the DDV and TDV would have severe impacts with the DDV and TDV.

Under Alternative 4, the number of severe noise impacts on sensitive receptors in the San Jose Diridon Station Approach Subsection would be the same with and without the DDV. With the DDV, there would be one additional moderate noise impact at a residential land use under Alternative 4.

Without the TDV, there would be 4 to 109 severe noise impacts on sensitive receptors in the Morgan Hill and Gilroy Subsection depending on alternative. With the increased speeds from 200 mph to 220 mph in the tunnel approaches facilitated by the TDV, the number of severe noise impacts on sensitive receptors would increase by one to five receptors depending on the alternative. Some of these impacts may be able to be reduced with noise barrier mitigation. With the TDV, there would also be three to seven more moderate noise impacts compared to the alternatives without the TDV in this subsection.

[9] The Skyway Drive Variants A and B under Alternative 2 would result in no measurable differences in noise impacts on sensitive receptors.

[10] While the physical extents of the TDV are in the Morgan Hill and Gilroy and Pacheco Pass Subsections, the effects related to noise and vibration would extend into the San Joaquin Valley Subsection.

In all four alternatives, the number of severe noise impacts in the Pacheco Pass Subsection would be the same with and without the TDV. With the TDV, the number of moderate noise impacts on sensitive receptors would increase by one receptor in all four alternatives.

In the four alternatives without the TDV, there would be 25 severe noise impacts on sensitive receptors in the San Joaquin Valley Subsection. With the TDV, the number of severe noise impacts on sensitive receptors would increase by two receptors for each alternative. With the TDV, there would also be two fewer moderate noise impacts than without the TDV in all four alternatives.

Table 3.4-16 Summary of 2029 No Project and 2029 Plus Project Noise Impacts

Subsection	Land Use Category[1]	No Project		Alternative 1		Alternative 2		Alternative 3		Alternative 4	
		Mod	Sev	Mod	Sev	Mod	Sev	Mod	Sev	Mod	Sev
San Jose Diridon Station Approach	2	0	0	1	3	11	0	11	0	84 (85)	38
	1, 3	0	0	0	0	0	0	0	0	0	0
Monterey Corridor	2	0	0	61	4	25	4	61	4	252	17
	1, 3	0	0	0	0	0	0	0	0	0	0
Morgan Hill and Gilroy	2	0	0	158 (162)	14 (16)	473 (477)	8 (11)	66 (73)	4 (5)	574 (577)	109 (114)
	1, 3	0	0	1	0	1 (0)	0	0	0	2	0
Pacheco Pass	2	0	0	9 (10)	1	9 (10)	1	9 (10)	1	9 (10)	1
	1, 3	0	0	0	0	0	0	0	0	0	0
San Joaquin Valley	2	0	0	80 (78)	25 (27)	80 (78)	25 (27)	80 (78)	25 (27)	80 (78)	25 (27)
	1, 3	0	0	0	0	0	0	0	0	0	0
Subtotal	**2**	**0**	**0**	**309 (312)**	**47 (51)**	**598 (601)**	**38 (43)**	**227 (233)**	**34 (37)**	**999 (1,002)**	**190 (197)**
	1, 3	**0**	**0**	**1**	**0**	**1 (0)**	**0**	**0**	**0**	**2**	**0**
Total	**1, 2, 3**	**0**	**0**	**310 (313)**	**47 (51)**	**599 (601)**	**38 (43)**	**227 (233)**	**34 (37)**	**1,001 (1,004)**	**190 (197)**

[1] FRA Land Use Categories are summarized in Table 3.4-5. Land Use Category 1 = Areas where quiet is an essential element to the land use; Category 2 = Residential; Category 3 = Institutional use and passive-use parks.
[2] Impacts associated with the design variants are shown in parentheses. The DDV affects Alternative 4 within the San Jose Diridon Station Approach Subsection; the remaining noise impacts are associated with the TDV.
Mod = the number of noise sensitive receptors that would experience a moderate noise impact
Sev = the number of noise sensitive receptors that would experience a severe noise impact

The difference in operations noise impacts between the four project alternatives is predominantly a result of the vertical and horizontal profile of each alternative. The greatest difference among the alternatives occurs in the Morgan Hill and Gilroy Subsection. Many Alternative 4 noise impacts would result from HSR train horns. Alternative 2 would have a longer embankment profile than Alternatives 1 and 3, which are predominantly on aerial structures. Although the aerial structures of Alternatives 1 and 3 would be much higher in the air (which can sometimes lead to higher sound levels because of less ground attenuation), the design of the aerial structures include a 3-foot-high parapet wall that functions as a short noise barrier. This parapet wall would

reduce the noise levels from the propulsion and wheel-rail subsources under Alternatives 1 and 3, resulting in fewer noise impacts compared to Alternatives 2 and 4. The horizontal alignment near Gilroy further differentiates the noise and vibration impacts among the four project alternatives. Alternatives 1, 2, and 4 would extend through downtown Gilroy, while Alternative 3 would extend east of Gilroy through rural agricultural lands that are sparsely populated and have fewer sensitive receptors.

Table 3.4-17 shows the results of the 2040 No Project and 2040 Plus Project conditions noise impact assessment. Alternative 1 would result in 337 severe impacts and 1,200 moderate impacts; Alternative 2 would result in 755 severe impacts and 1,844 moderate impacts; Alternative 3 would result in 222 severe impacts and 834 moderate impacts; and Alternative 4 would result in 1,212 severe impacts and 1,666 moderate impacts. Noise impacts, before mitigation, associated with the DDV (which applies only to Alternative 4 in the San Jose Diridon Station Approach Subsection) and the TDV (which applies to all alternatives within the Morgan Hill and Gilroy, Pacheco Pass, and San Joaquin Valley Subsections) are shown in parentheses in Table 3.4-17. In some cases, new receptors would have moderate or severe noise impacts with the DDV and TDV. In some cases, receptors that would not have moderate or severe noise impacts without the DDV and TDV would have moderate or severe impacts with the DDV and TDV. In some cases, receptors that would have moderate noise impacts without the DDV and TDV would have severe impacts with the DDV and TDV.

Under Alternative 4 with the DDV, there would be a horizontal shift of the alignment up to 37 feet and increased speed from 15 mph to 40 mph in the San Jose Diridon Station Approach Subsection. However, there would be no difference in the noise impacts with or without the DDV.

Without the TDV, there would be 65 to 671 severe noise impacts on sensitive receptors in the Morgan Hill and Gilroy Subsection depending on alternative. With the increased speeds from 200 mph to 220 mph in the tunnel approaches facilitated by the TDV, the number of severe noise impacts on sensitive receptors would increase by seven to nine receptors depending on the alternative. Some of these impacts may be able to be reduced with noise barrier mitigation. With the TDV, there would also be 3 to 6 fewer moderate noise impacts with Alternatives 1, 2, or 4 and 13 more moderate noise impacts with Alternative 3 compared to the alternatives without the TDV in this subsection.

In the four alternatives without the TDV, there would be 10 severe noise impacts on sensitive receptors in the Pacheco Pass Subsection. With the TDV, the number of severe noise impacts on sensitive receptors would increase by one receptor in all four alternatives.

In the four alternatives without the TDV, there would be 101 severe noise impacts on sensitive receptors in the San Joaquin Valley Subsection. With the TDV, the number of severe noise impacts on sensitive receptors would increase by two receptors for each alternative. With the TDV, there would also be two fewer moderate noise impacts than without the TDV in all four alternatives.

The most noise impacts would occur under Alternative 4, followed by Alternative 2, Alternative 1, and Alternative 3. The results of the 2040 Plus Project noise impact assessment indicate significantly more noise impacts relative to those of the 2029 Plus Project noise impact assessment due to increased operations.

Table 3.4-17 Summary of 2040 No Project and 2040 Plus Project Noise Impacts

Subsection	Land Use Category[1]	No Project		Alternative 1		Alternative 2		Alternative 3		Alternative 4	
		Mod	Sev	Mod	Sev	Mod	Sev	Mod	Sev	Mod	Sev
San Jose Diridon Station Approach	2	0	0	117	20	73	0	73	0	218	136
	1, 3	0	0	1	0	0	0	0	0	3	0
Monterey Corridor	2	0	0	225	46	326	46	225	46	264	293
	1, 3	0	0	1	0	1	0	1	0	3	0
Morgan Hill and Gilroy	2	0	0	815 (812)[2]	160 (167)	1,399 (1,395)	598 (606)	498 (511)	65 (73)	1,133 (1,127)	671 (680)
	1, 3	0	0	4	0	8	0	0	0	8	1
Pacheco Pass	2	0	0	4	10 (11)	4	10 (11)	4	10 (11)	4	10 (11)
	1, 3	0	0	0	0	0	0	0	0	0	0
San Joaquin Valley	2	0	0	32 (30)	101 (103)	32 (30)	101 (103)	32 (30)	101 (103)	32 (30)	101 (103)
	1, 3	0	0	1	0	1	0	1	0	1	0
Subtotal	**2**	**0**	**0**	**1,193 (1,188)**	**337 (347)**	**1,834 (1,828)**	**755 (766)**	**832 (843)**	**222 (233)**	**1,651 (1,643)**	**1,211 (1,223)**
	1, 3	**0**	**0**	**7**	**0**	**10**	**0**	**2**	**0**	**15**	**1**
Total	**1,2,3**	**0**	**0**	**1,200 (1,195)**	**337 (347)**	**1,844 (1,838)**	**755 (766)**	**834 (845)**	**222 (233)**	**1,666 (1,658)**	**1,212 (1,224)**

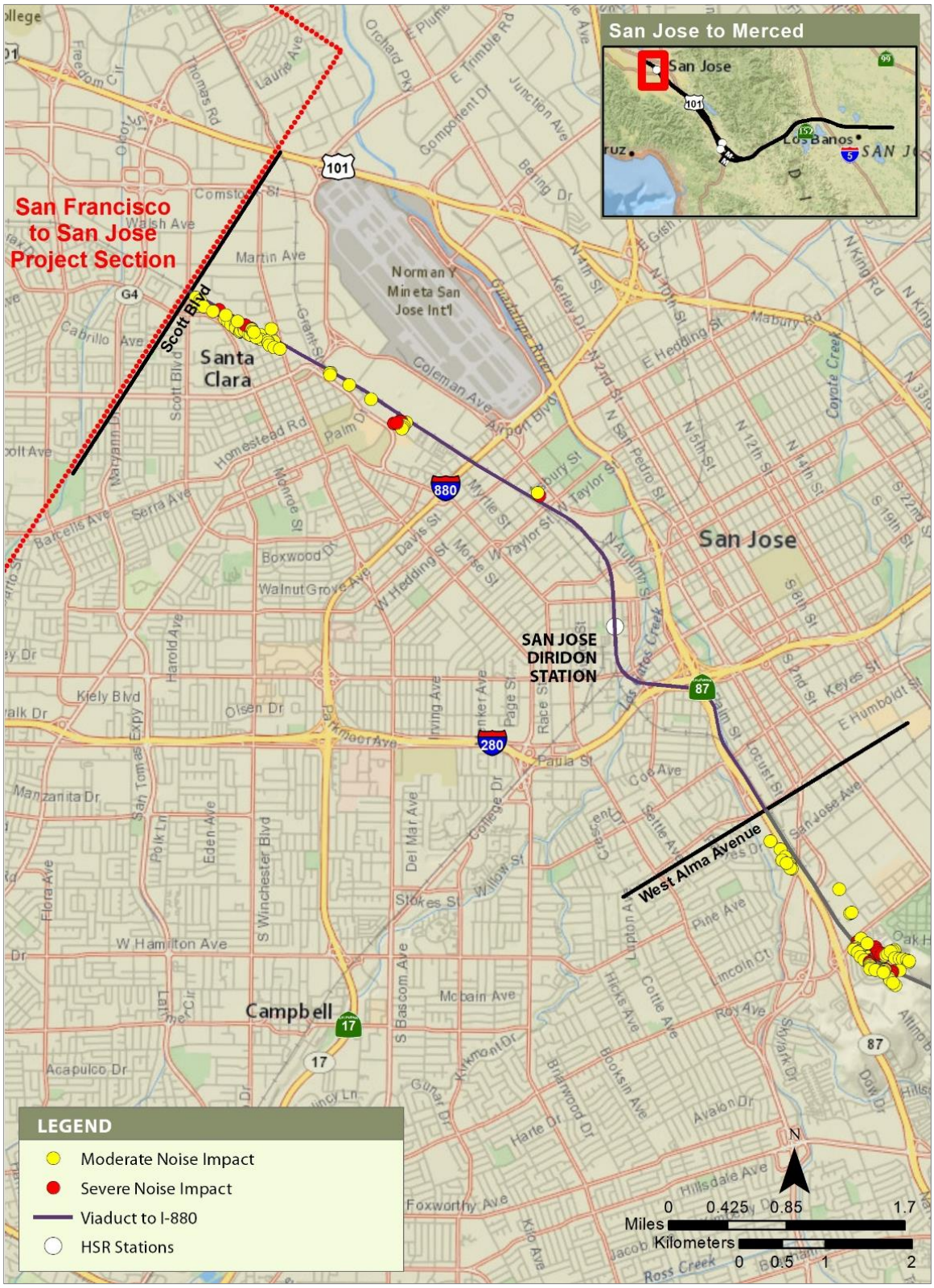
[1] FRA Land Use Categories are summarized in Table 3.4-5. Land Use Category 1 = Areas where quiet is an essential element to the land use; Category 2 = Residential; Category 3 = Institutional use and passive-use parks.
[2] Impacts associated with the design variants are shown in parentheses. The DDV affects Alternative 4 within the San Jose Diridon Station Approach Subsection; the remaining noise impacts are associated with the TDV.
Mod = the number of noise sensitive receptors that would experience a moderate noise impact
Sev = the number of noise sensitive receptors that would experience a severe noise impact

Figure 3.4-8 through Figure 3.4-21 illustrate the 2040 Plus Project noise impact locations for each project alternative. For the San Jose Diridon Station Approach Subsection, the Monterey Corridor Subsection, and the Morgan Hill and Gilroy Subsection, the noise impact locations for Alternative 1 are illustrated on Figure 3.4-8 through Figure 3.4-10. For the Pacheco Pass and San Joaquin Valley Subsections, the noise impact locations are the same for the four project alternatives and are illustrated on Figure 3.4-11 and Figure 3.4-12. Noise impact locations for the San Jose Diridon Station Approach, the Monterey Corridor, and the Morgan Hill and Gilroy Subsections for Alternative 2 are illustrated on Figure 3.4-13 through Figure 3.4-15; noise impact locations for these three subsections for Alternative 3 are illustrated on Figure 3.4-16 through Figure 3.4-18; and noise impact locations for these three subsections for Alternative 4 are illustrated on Figure 3.4-19 through Figure 3.4-21. Each red dot indicates a cluster of receptors predicted to have severe impacts and each yellow dot indicates a cluster of receptors predicted to have moderate impacts for the 2040 Plus Project condition. More detailed maps illustrating the 2040 Plus Project noise impact locations for each alternative are included in Volume 2, Appendix 3.4-C.

Implementation of the project alternatives would change the current practices regarding the sounding of train horns and crossing bells in the noise RSA. Most of the length of Alternatives 1 and 3 would be grade separated and on aerial structures. As a result, there are no locations where HSR trains would regularly sound warning horns. Alternative 1 would eliminate one

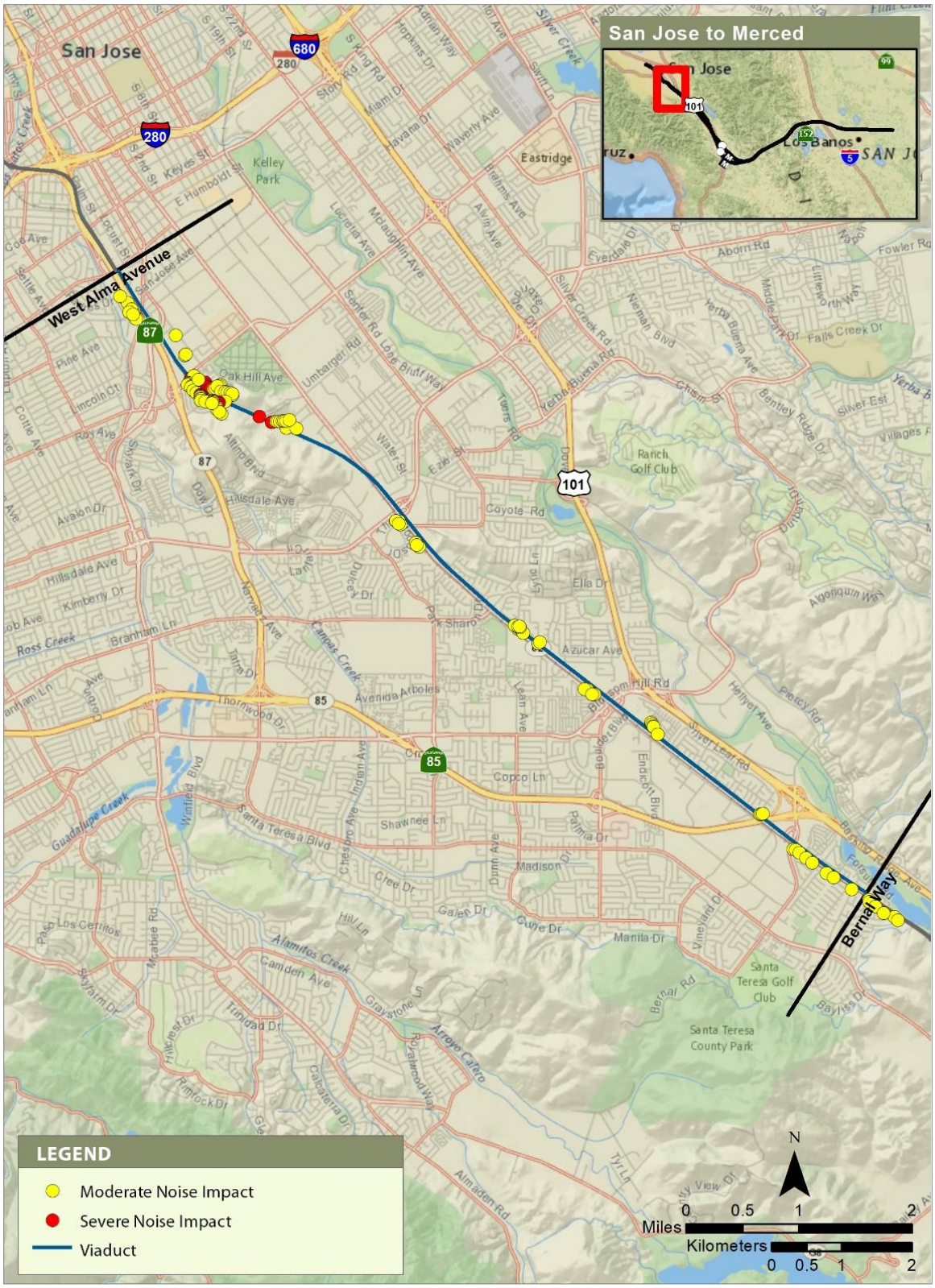
existing at-grade railway crossing at Bloomfield Avenue in Gilroy, which would eliminate horn noise at that location. Alternative 2 would be predominantly located on an embankment in or adjacent to the existing Caltrain/UPRR railway, which would necessitate the elimination of 33 existing at-grade crossings where trains currently sound warning horns. The elimination of at-grade crossings associated with Alternative 2 would produce a beneficial impact because of reduced noise exposure from horns and crossing bells. Existing trains would still sound horns at Caltrain stations with Alternative 2.

Alternative 4 would be at grade at the same locations as the existing Caltrain and other passenger and freight operations. As a result, HSR trains under Alternative 4 would regularly sound warning horns at all at-grade crossings and Caltrain passenger stations.



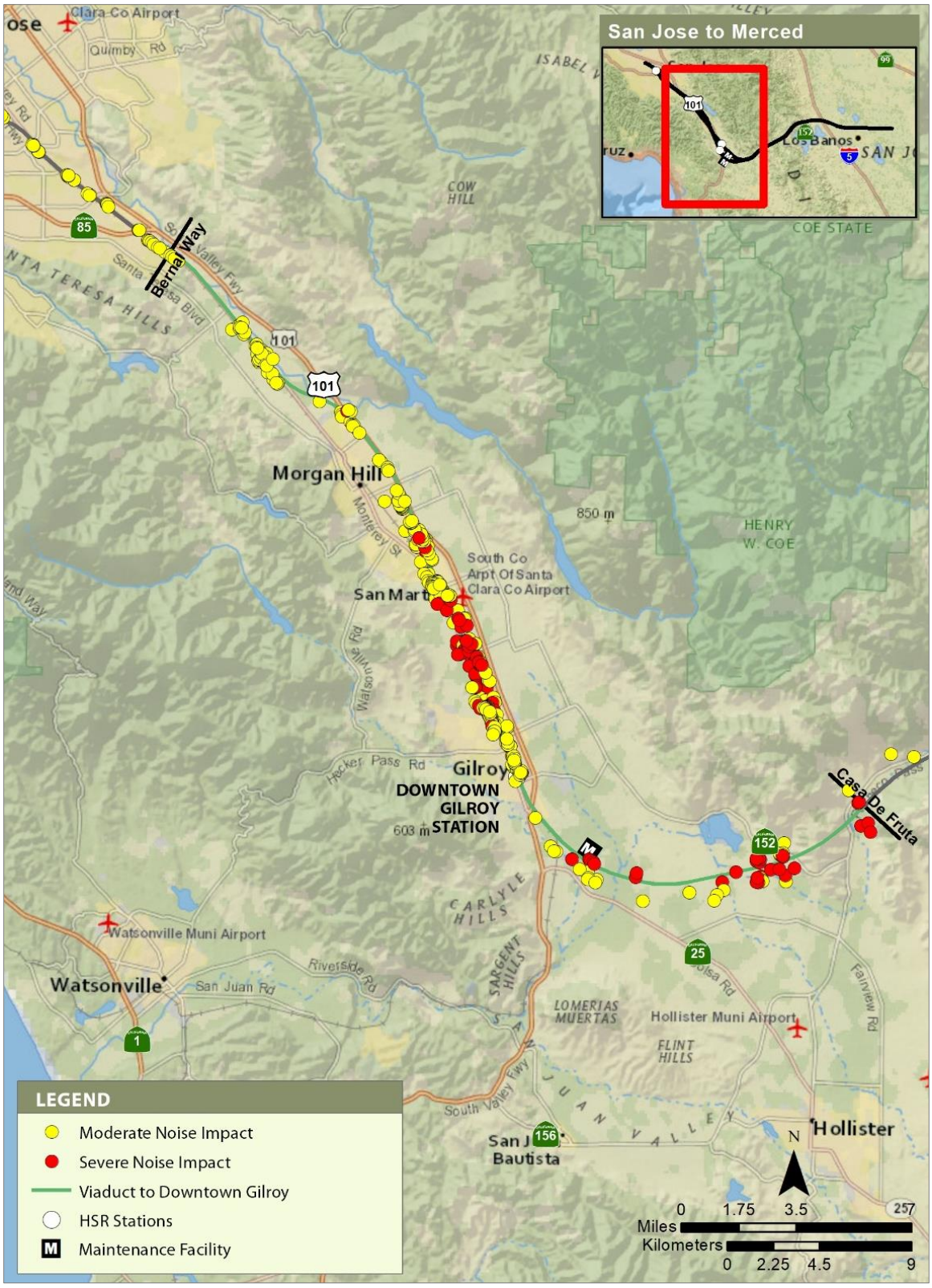
SEPTEMBER 2020

Figure 3.4-8 2040 Plus Project Noise Impacts—Alternative 1 (San Jose Diridon Station Approach Subsection)



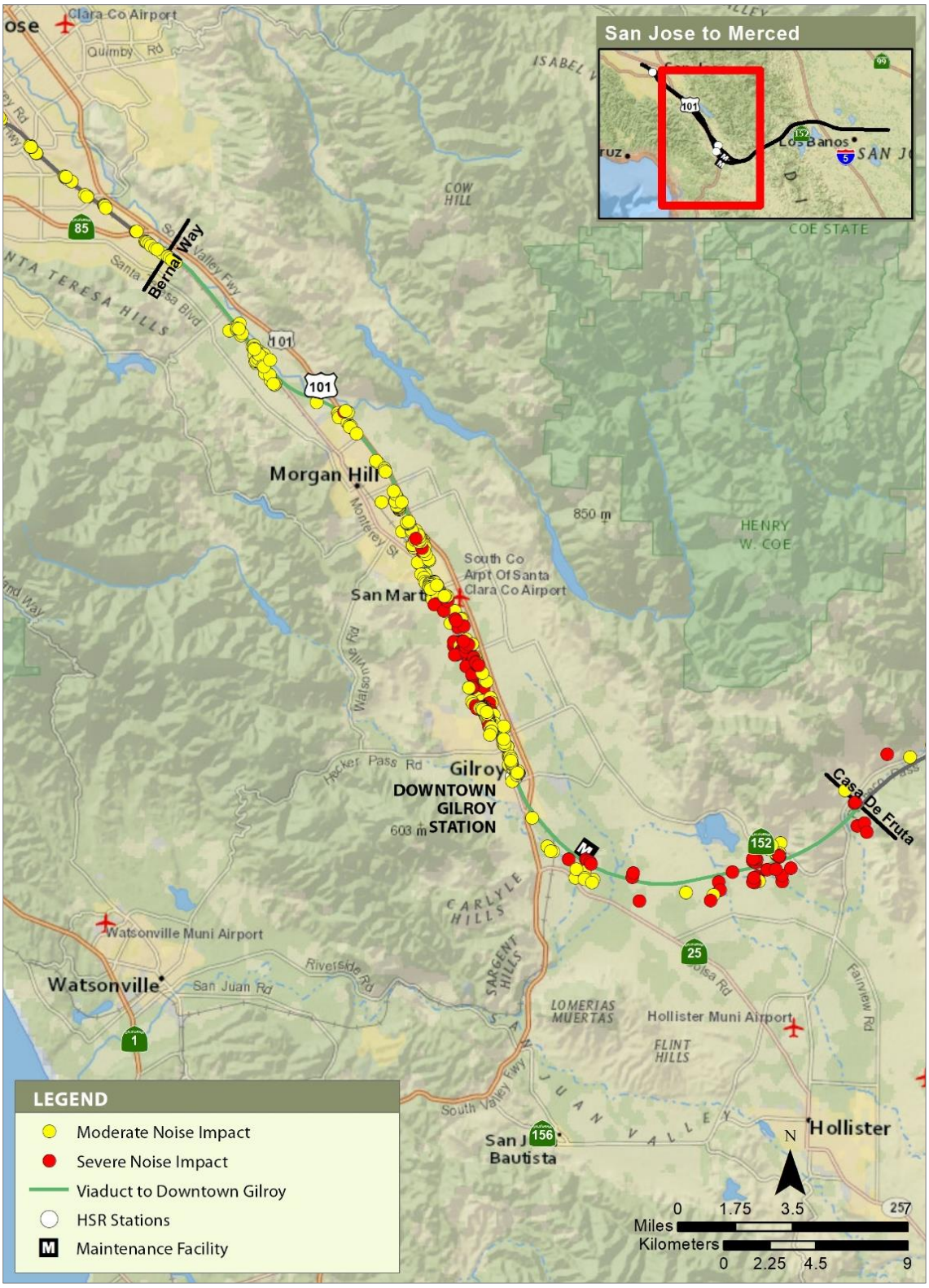
SEPTEMBER 2020

Figure 3.4-9 2040 Plus Project Noise Impacts—Alternative 1 (Monterey Corridor Subsection)



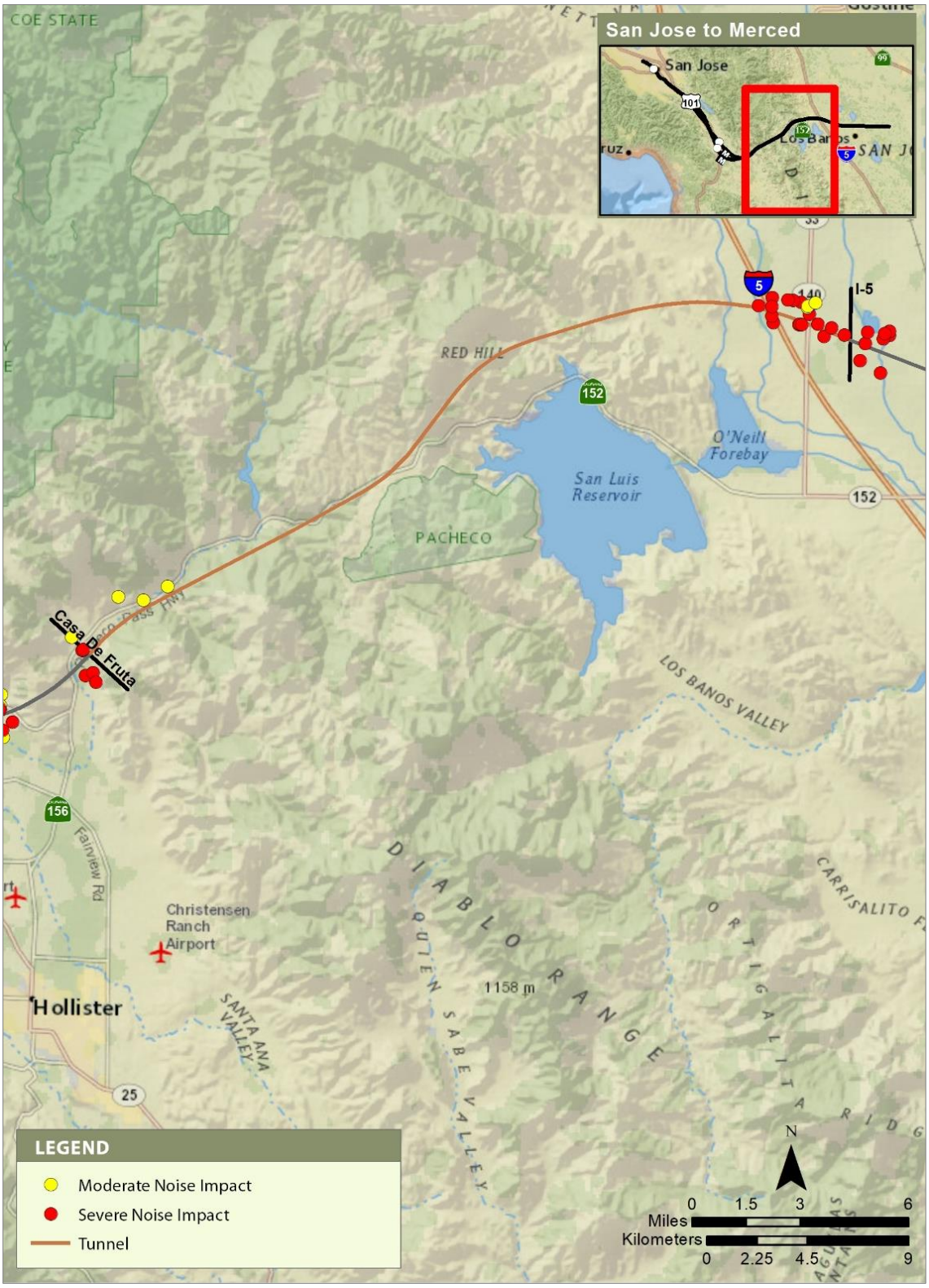
SEPTEMBER 2020

Figure 3.4-10a 2040 Plus Project Noise Impacts—Alternative 1 without the Tunnel Design Variant (Morgan Hill and Gilroy Subsection)



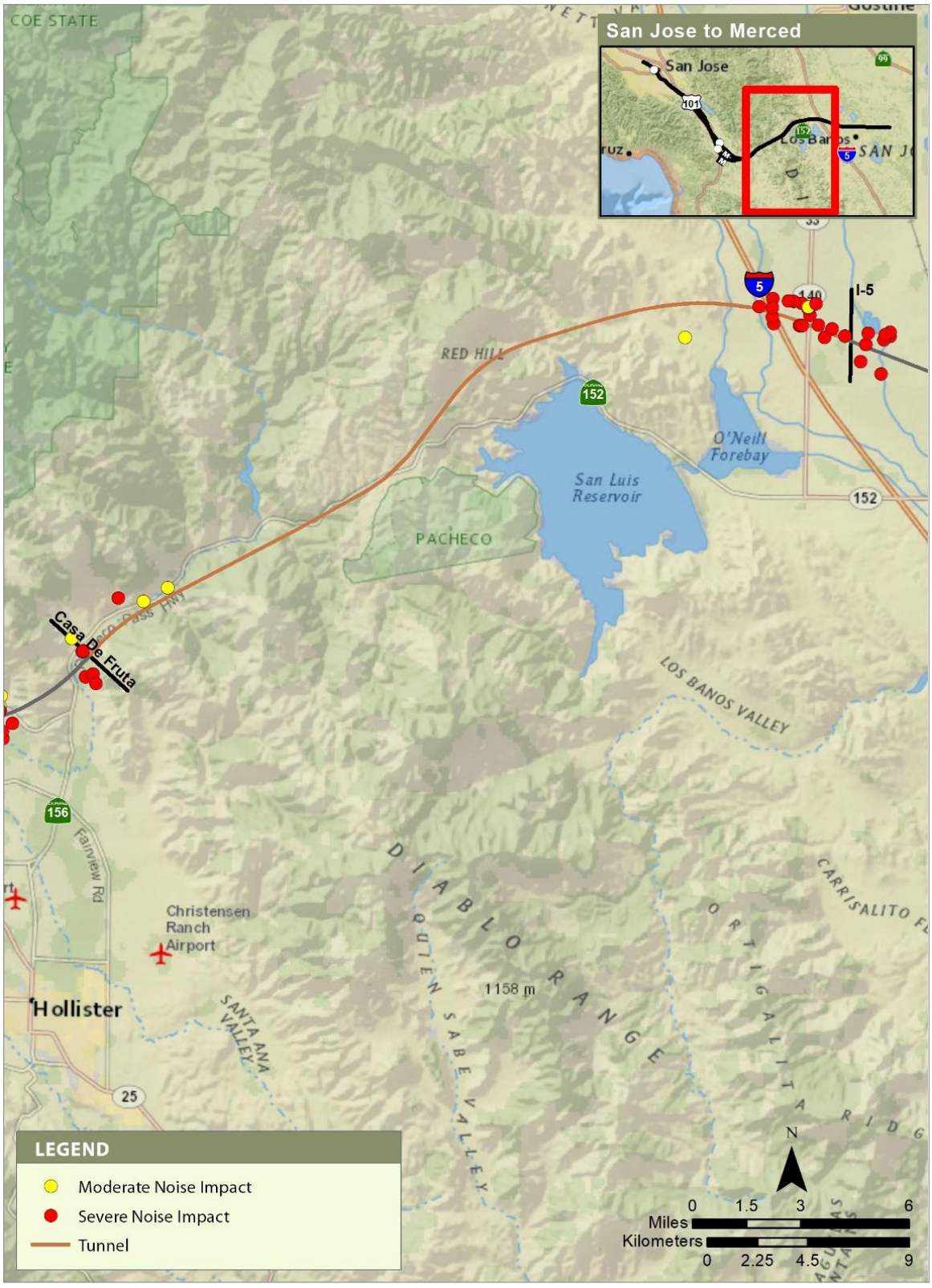
SEPTEMBER 2020

Figure 3.4-10b 2040 Plus Project Noise Impacts—Alternative 1 with the Tunnel Design Variant (Morgan Hill and Gilroy Subsection)



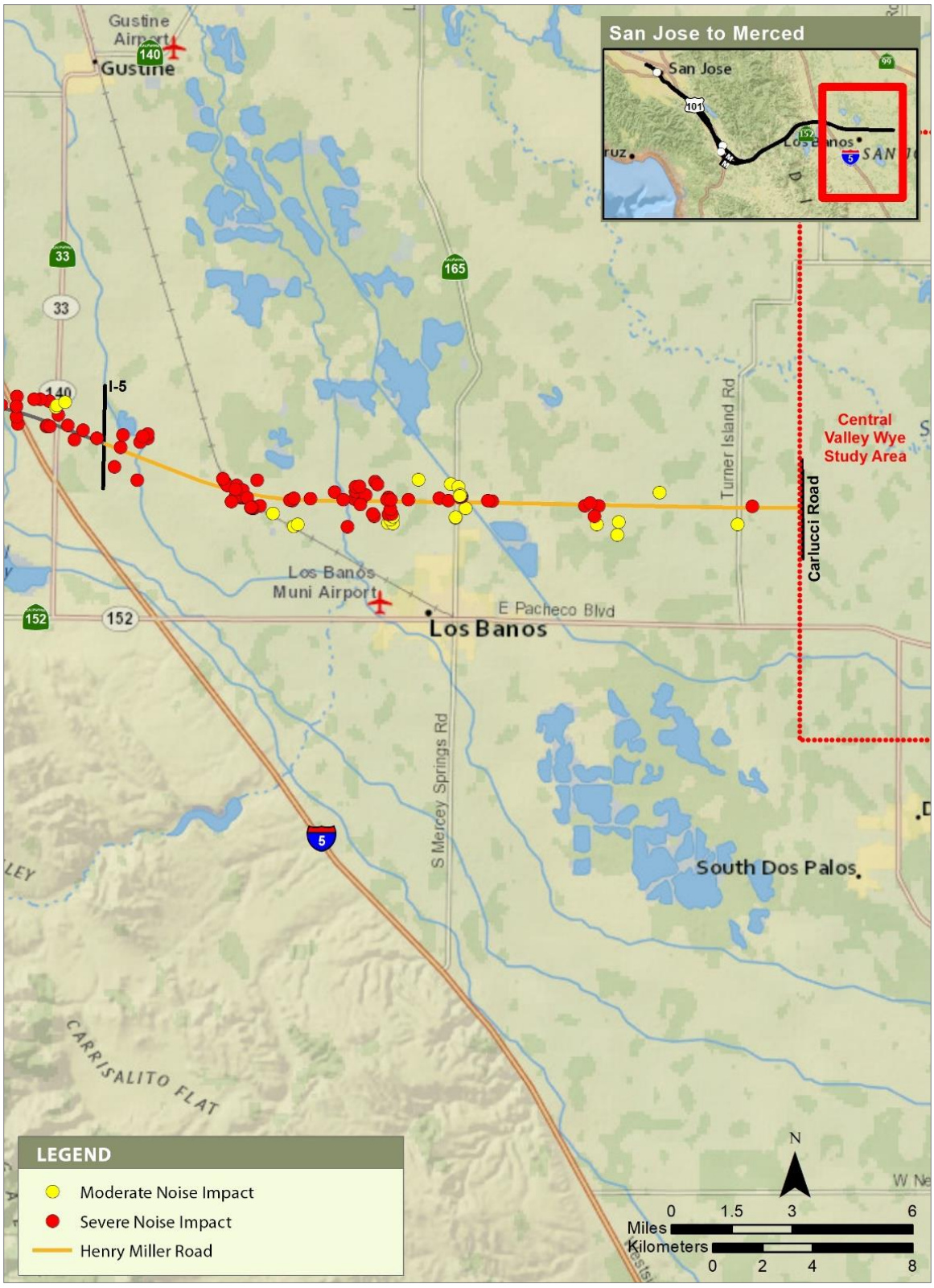
SEPTEMBER 2020

Figure 3.4-11a 2040 Plus Project Noise Impacts—Alternatives 1, 2, 3, and 4 without the Tunnel Design Variant (Pacheco Pass Subsection)



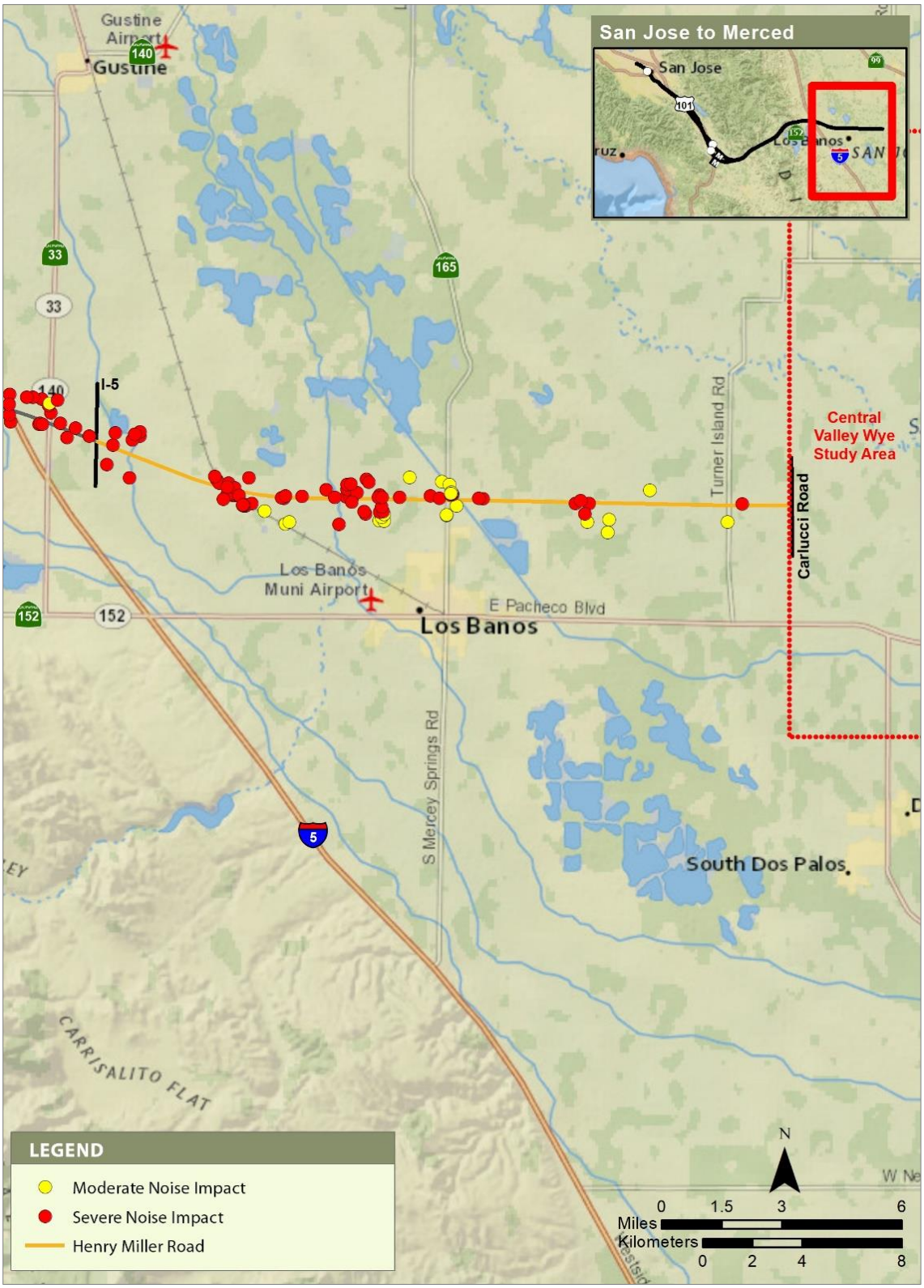
SEPTEMBER 2020

Figure 3.4-11b 2040 Plus Project Noise Impacts—Alternatives 1, 2, 3, and 4 with the Tunnel Design Variant (Pacheco Pass Subsection)



SEPTEMBER 2020

Figure 3.4-12a 2040 Plus Project Noise Impacts—Alternatives 1, 2, 3, and 4 without the Tunnel Design Variant (San Joaquin Valley Subsection)

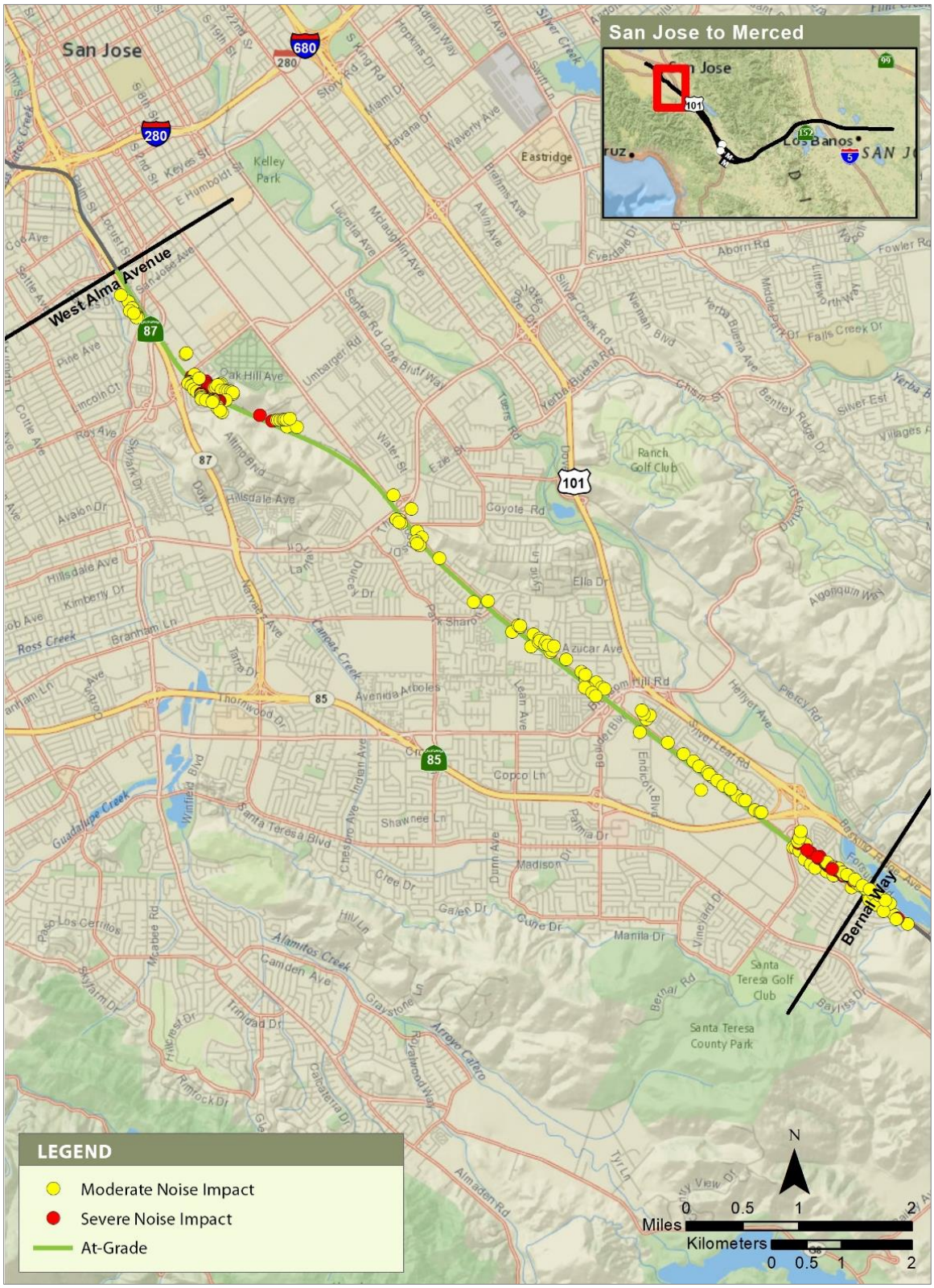


SEPTEMBER 2020

Figure 3.4-12b 2040 Plus Project Noise Impacts—Alternatives 1, 2, 3, and 4 with the Tunnel Design Variant (San Joaquin Valley Subsection)

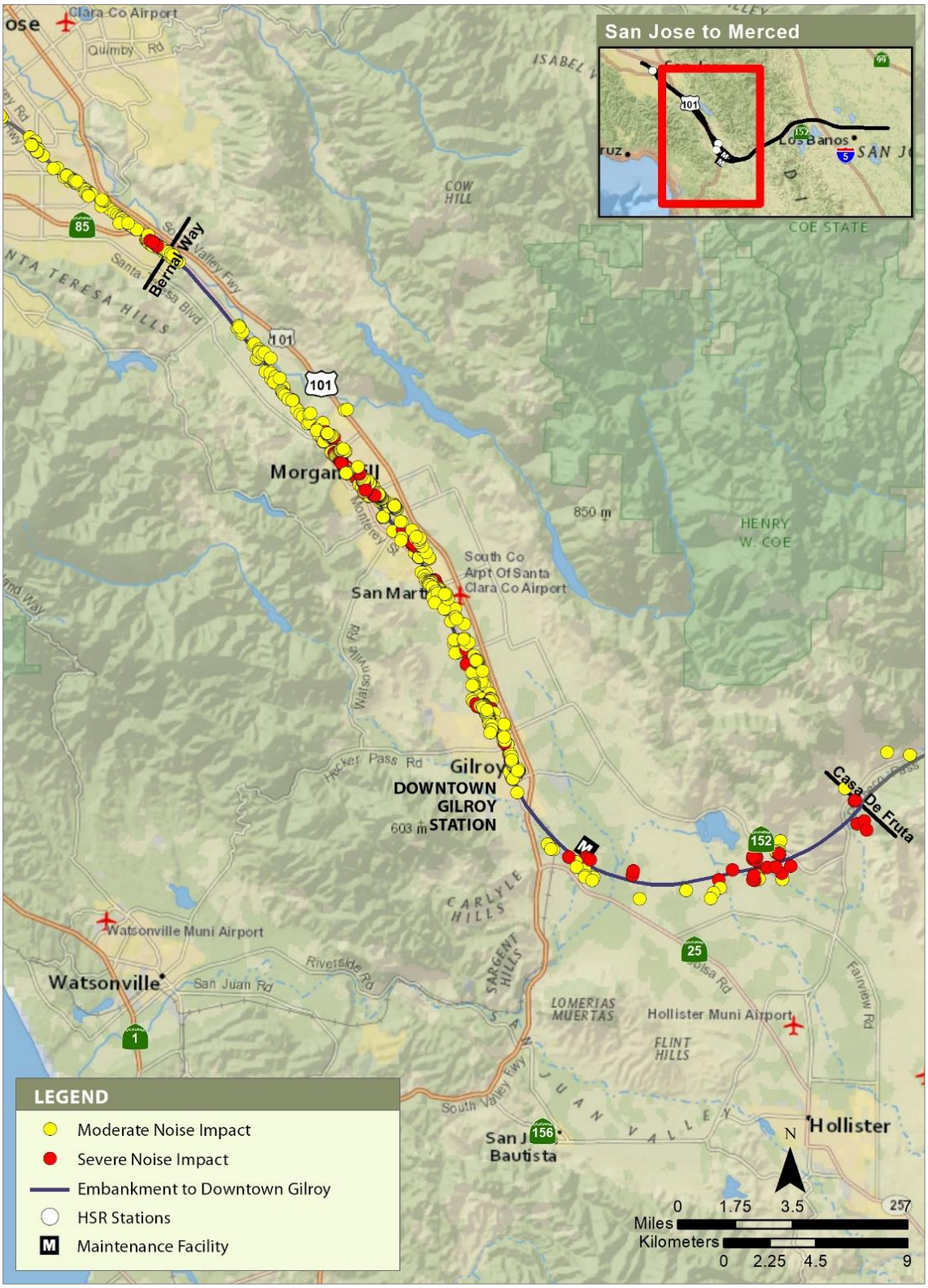
SEPTEMBER 2020

Figure 3.4-13 2040 Plus Project Noise Impacts—Alternative 2 (San Jose Diridon Station Approach Subsection)



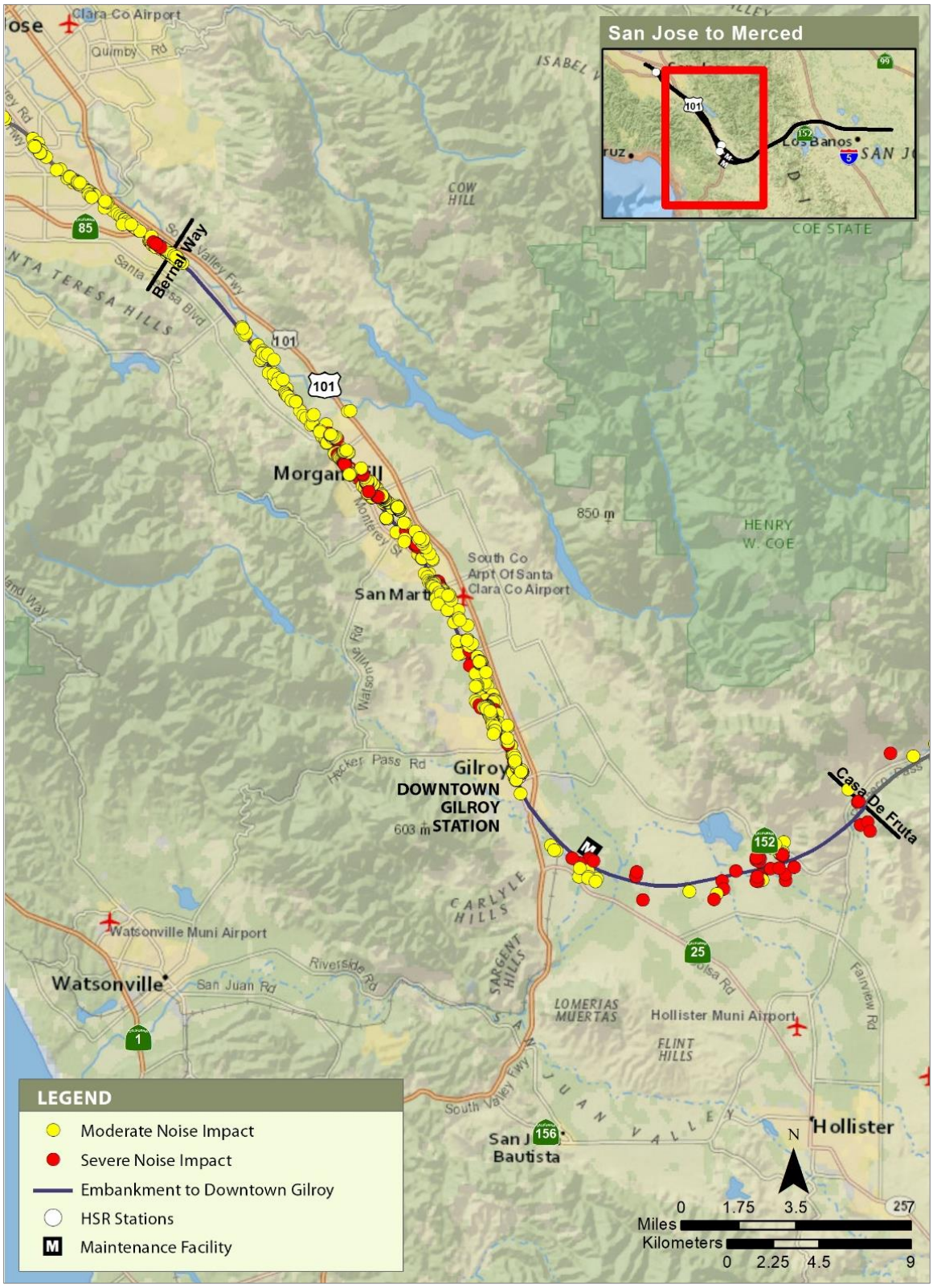
SEPTEMBER 2020

Figure 3.4-14 2040 Plus Project Noise Impacts—Alternative 2 (Monterey Corridor Subsection)



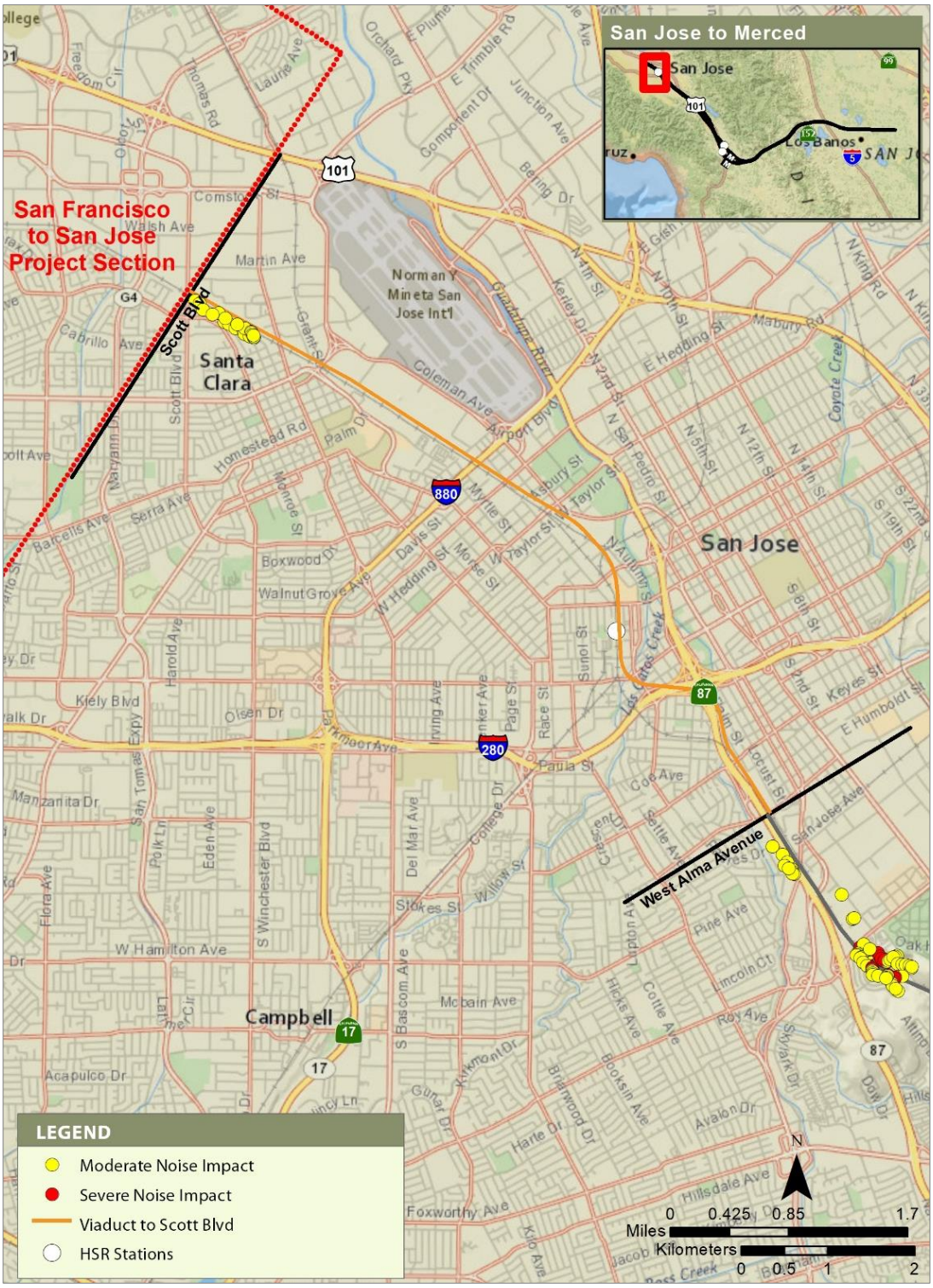
SEPTEMBER 2020

Figure 3.4-15a 2040 Plus Project Noise Impacts—Alternative 2 without the Tunnel Design Variant (Morgan Hill and Gilroy Subsection)



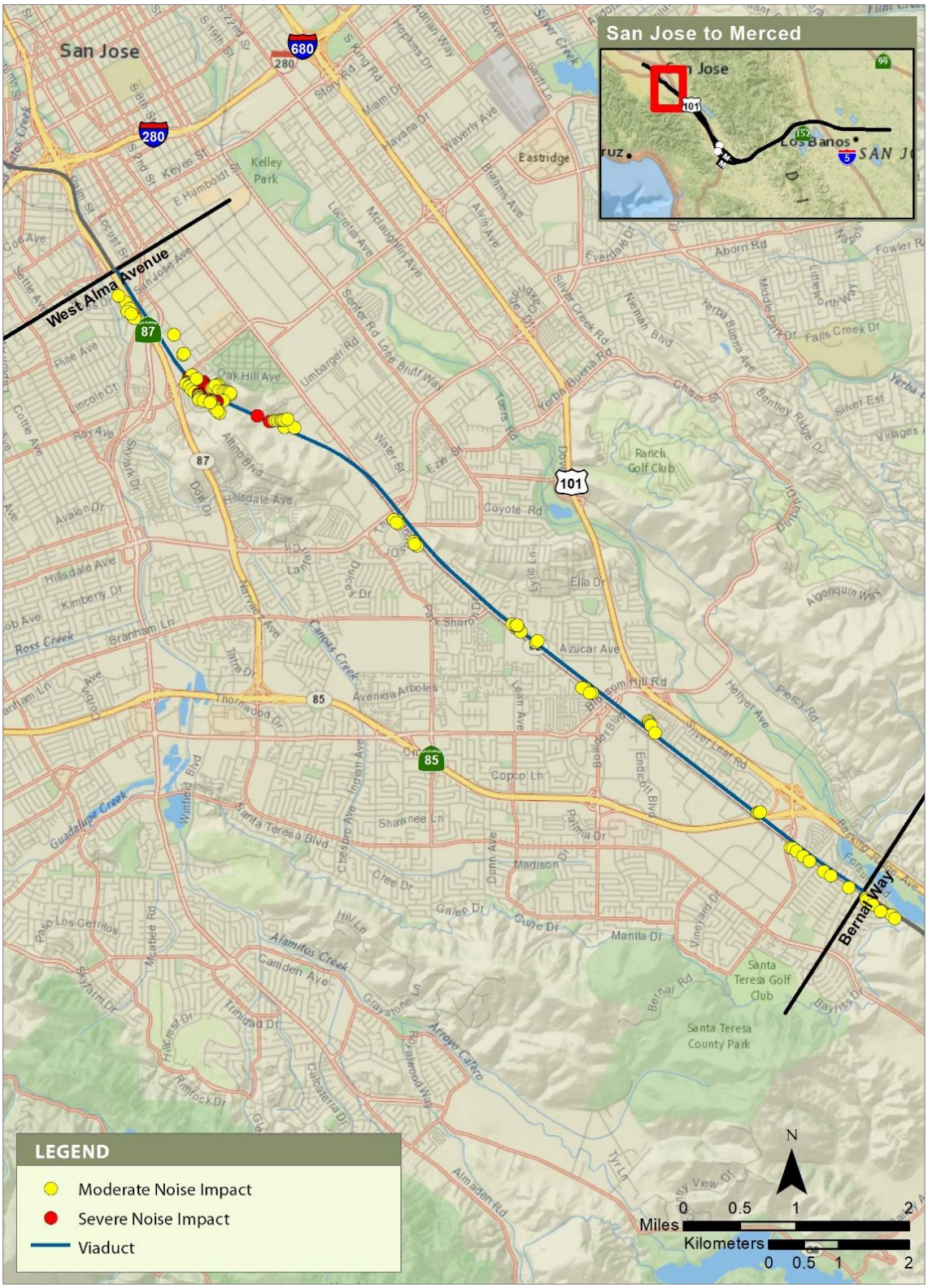
SEPTEMBER 2020

Figure 3.4-15b 2040 Plus Project Noise Impacts—Alternative 2 with the Tunnel Design Variant (Morgan Hill and Gilroy Subsection)



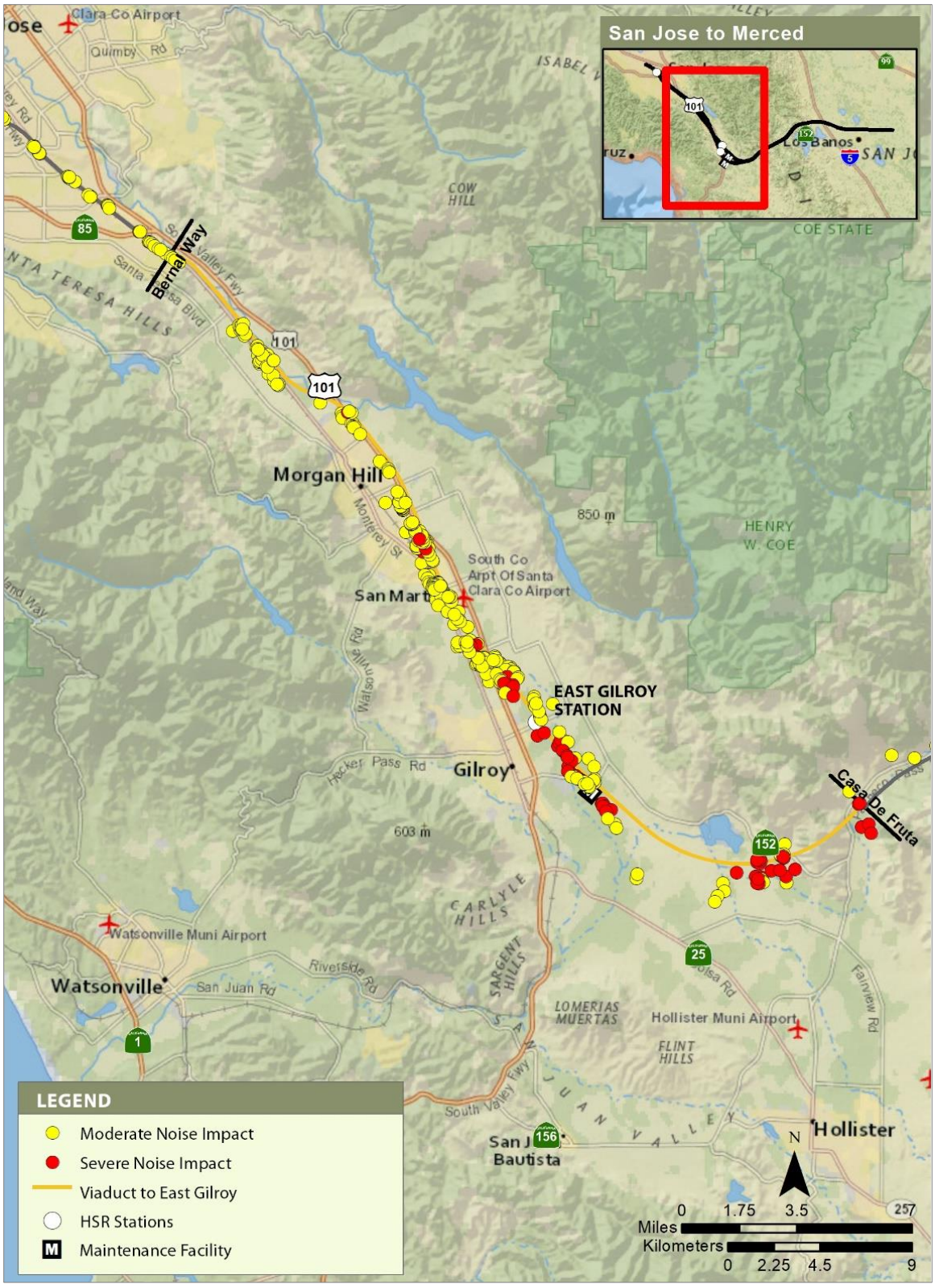
SEPTEMBER 2020

Figure 3.4-16 2040 Plus Project Noise Impacts—Alternative 3 (San Jose Diridon Station Approach Subsection)



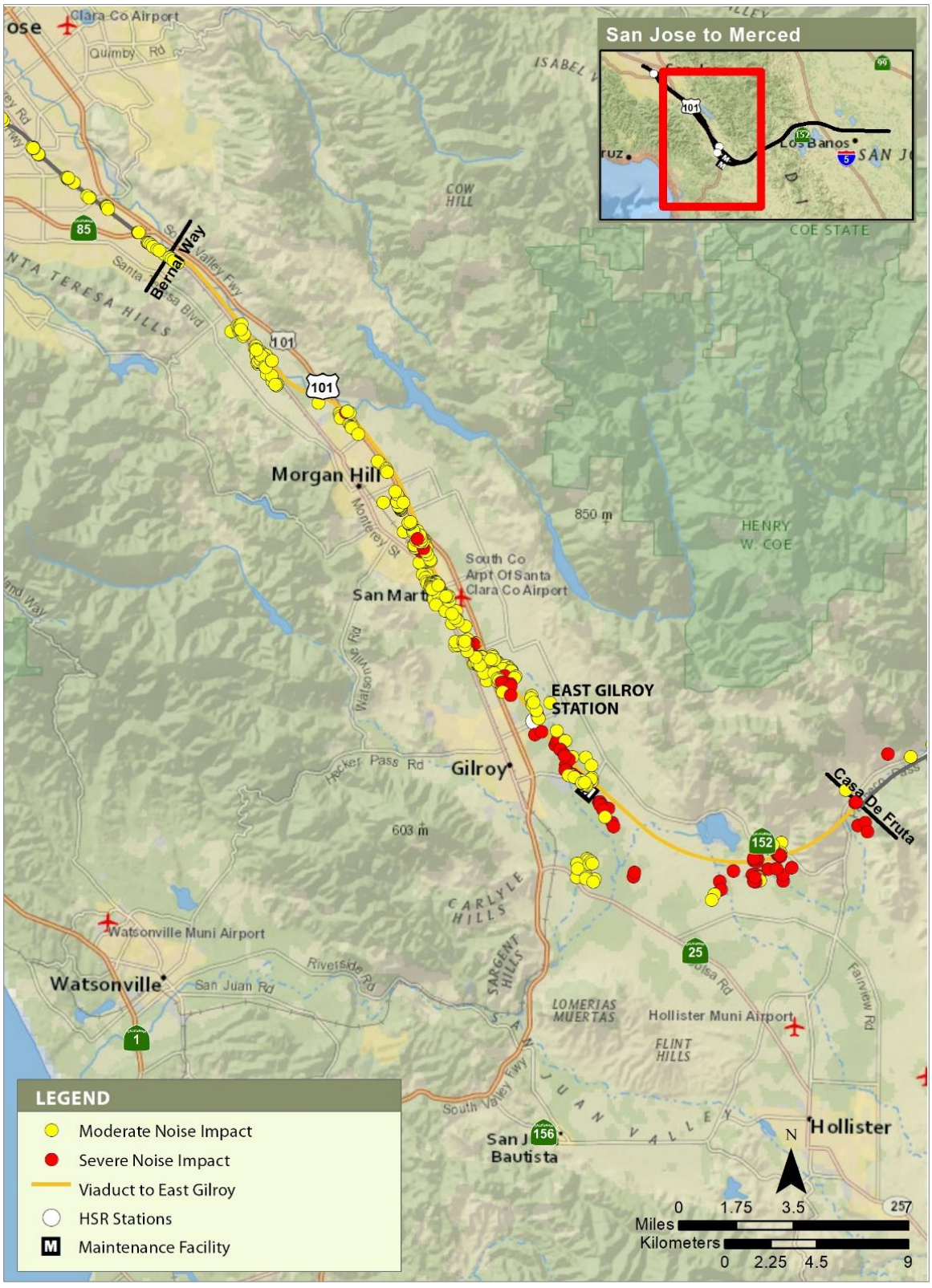
SEPTEMBER 2020

Figure 3.4-17 2040 Plus Project Noise Impacts—Alternative 3 (Monterey Corridor Subsection)



SEPTEMBER 2020

Figure 3.4-18a 2040 Plus Project Noise Impacts—Alternative 3 without the Tunnel Design Variant (Morgan Hill and Gilroy Subsection)

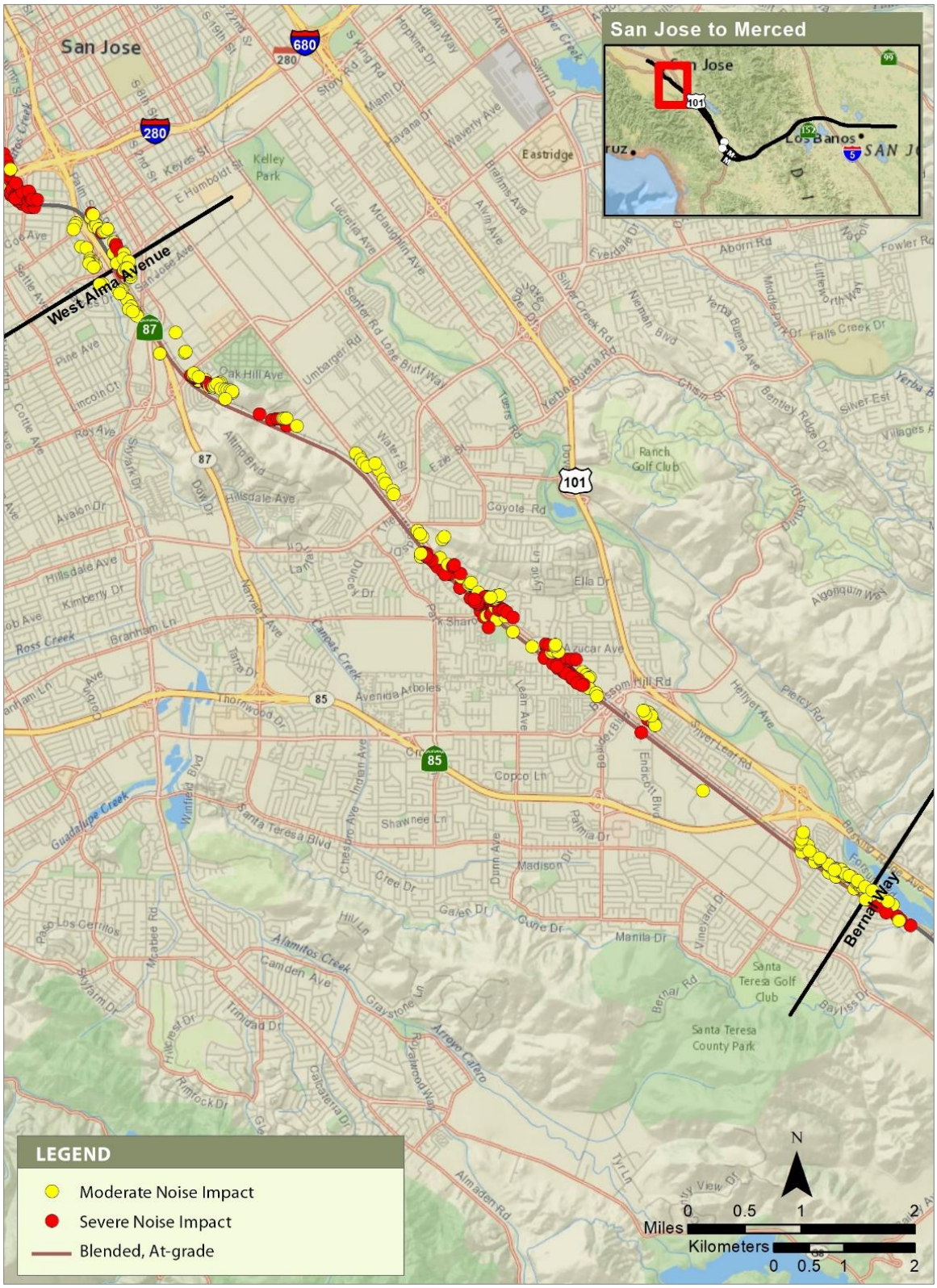


SEPTEMBER 2020

Figure 3.4-18b 2040 Plus Project Noise Impacts—Alternative 3 with the Tunnel Design Variant (Morgan Hill and Gilroy Subsection)

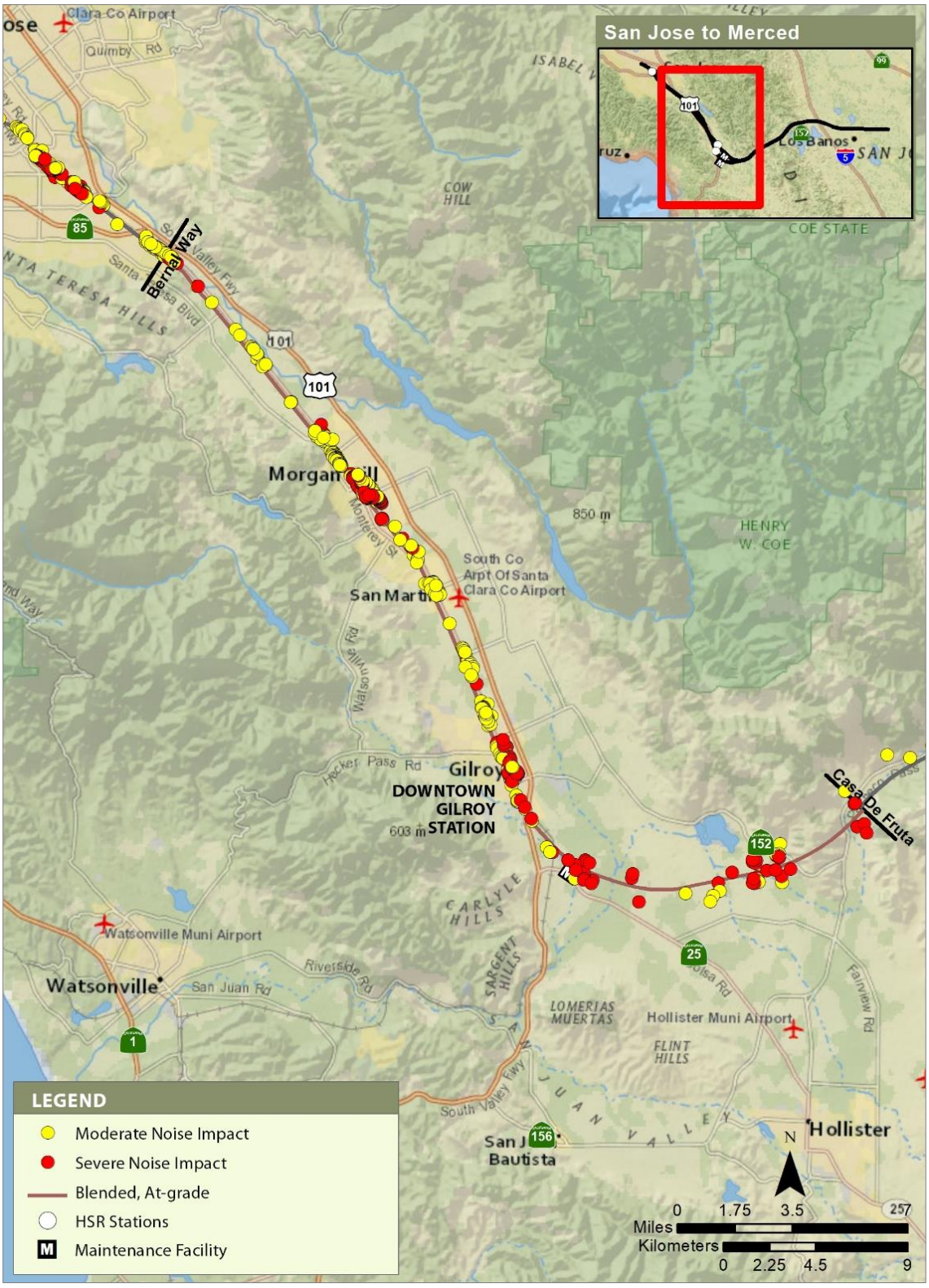
SEPTEMBER 2020

Figure 3.4-19 2040 Plus Project Noise Impacts—Alternative 4 (San Jose Diridon Station Approach Subsection)



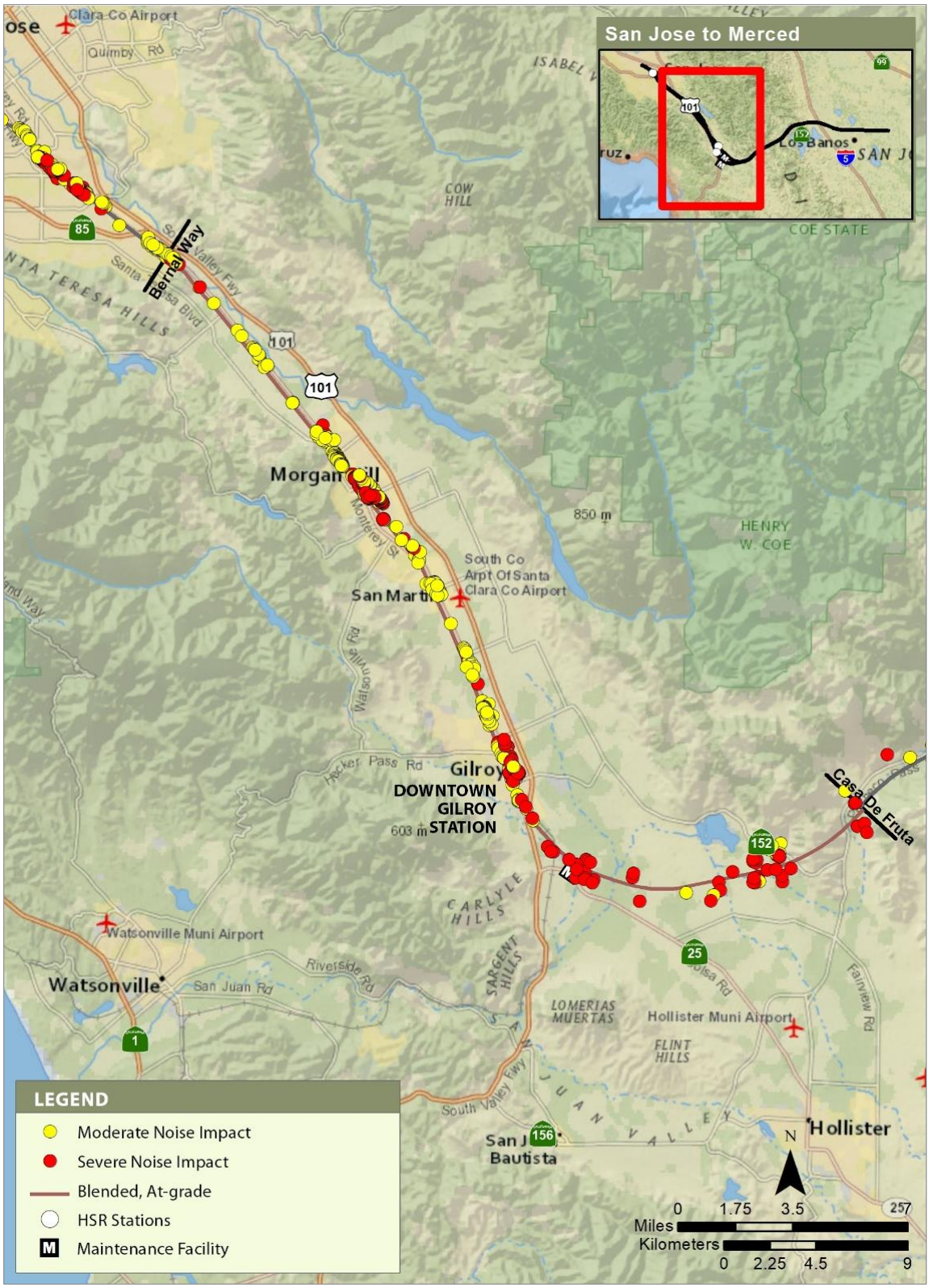
SEPTEMBER 2020

Figure 3.4-20 2040 Plus Project Noise Impacts—Alternative 4 (Monterey Corridor Subsection)



SEPTEMBER 2020

Figure 3.4-21a 2040 Plus Project Noise Impacts—Alternative 4 without the Tunnel Design Variant (Morgan Hill and Gilroy Subsection)



SEPTEMBER 2020

Figure 3.4-21b 2040 Plus Project Noise Impacts—Alternative 4 with the Tunnel Design Variant (Morgan Hill and Gilroy Subsection)

CEQA Conclusion

The impact under CEQA would be significant for all four project alternatives, with and without the DDV and TDV, because operations would generate noise levels above existing ambient levels and in exceedance of FRA criteria, causing severe noise impacts at sensitive receptors. This exceedance would occur under all four project alternatives and in both the opening year and 2040, although the most noise impacts would occur in 2040, and under Alternative 4, followed by Alternative 2, Alternative 1, and Alternative 3. The difference in operational noise impacts among project alternatives would be attributed to HSR horns with Alternative 4 and would be relative to the vertical and horizontal profile of each alternative, which would vary to the greatest extent in the Morgan Hill and Gilroy Subsection. Mitigation to address this impact is identified in Section 3.4.9, CEQA Significance Conclusions. Section 3.4.7, Mitigation Measures, describes the mitigation in detail.

Impact NV#3: Intermittent Permanent Exposure of Sensitive Receptors to Noise from HSR Passenger Station Parking

The project includes the construction of two HSR stations—one passenger station would be in San Jose adjacent to the existing San Jose Diridon Station and the other would be in Gilroy. The San Jose Diridon Station would be the same under Alternatives 1 through 3, with a variation under Alternative 4, and would remove and relocate approximately 226 parking spaces. Two station location options have been identified in Gilroy. Alternatives 1, 2, and 4 would include a Downtown Gilroy Station adjacent to the existing Gilroy Caltrain Station, while Alternative 3 would include an East Gilroy Station, which would be built in agricultural lands east of Gilroy. The Downtown Gilroy Station would have four parking areas with 1,710 total spaces, and the East Gilroy Station would have two parking areas with 1,520 total spaces.[11]

The evaluation of the noise generated from the station parking facilities determined that the San Jose Diridon Station parking facilities would result in an L_{dn} contribution of 29 dBA at nearby sensitive receptors. Near the Downtown Gilroy Station, the largest L_{dn} contribution from the parking facilities at the nearby noise receptors would be 40 dBA, while the East Gilroy Station parking facilities would have an L_{dn} contribution at the nearby noise receptors of 28 dBA. Accordingly, the additional noise from parking facilities would be substantially lower (at least 18 dB less) than the projected L_{dn} from project operations and would be nearly inaudible.

CEQA Conclusion

The impact under CEQA would be less than significant for all four project alternatives because operations of HSR passenger stations would provide only a minor contribution to the overall noise generated by project operations. Because the dominant noise source at HSR passenger stations would be train operations, the minor contribution of traffic in the station parking facilities would not result in the generation of noise levels in excess of standards for a severe impact established by the FRA. Therefore, CEQA does not require mitigation.

Impact NV#4: Intermittent Permanent Exposure of Sensitive Receptors to Noise from HSR Maintenance Facilities

The project would include the operation of one MOWF near Gilroy. There are three potential location options for the MOWF—a South Gilroy MOWF (south of the Downtown Gilroy Station under Alternatives 1 and 2), an East Gilroy MOWF (south of the East Gilroy Station under Alternative 3), and a South Gilroy MOWF south of the Downtown Gilroy Station under Alternative 4, but at a different location than Alternatives 1 and 2. At all three locations, the mainline HSR tracks would be directly adjacent to the MOWF and the HSR speeds would be approximately 200 mph. Therefore, the noise from project operations would dominate noise from occasional HSR train movements into and out of the MOWF.

[11] The analysis assumed that on a typical day during the three morning and afternoon peak hours, all the parking spaces would be filled once and vacated once (turned over). During the nonpeak, midday, and evening hours, the analysis assumed that a percentage of the parking space corresponding to the ridership peaking factors would turn over each hour (Authority 2008).

Analysts used preliminary layouts of the MOWFs near Gilroy to identify the approximate center of noise-producing activities at the facilities. The project operations schedule identified 24 planned HSR train movements into and out of the MOWF during the daytime and 12 movements during the nighttime. The L_{dn} contribution from these MOWF train movements was calculated at all nearby noise-sensitive receptors.

The closest identified receptor (single-family residence on Bolsa Road) to the South Gilroy MOWF under Alternatives 1 and 2 is more than 1,500 feet away. The L_{dn} contribution from the South Gilroy MOWF under Alternatives 1 and 2 at that nearest receptor would be 40 dBA, more than 20 dB less than the noise from HSR train operations at that receptor. The nearest receptors (residences on Pacheco Pass Highway in the rural residential Old Gilroy neighborhood) to the East Gilroy MOWF are approximately 800 feet away. In this neighborhood, the highest L_{dn} contribution from the MOWF would be 47 dBA, more than 20 dB less than noise from HSR train operations at that receptor. The nearest receptors to the Alternative 4 South Gilroy MOWF are approximately 900 feet away. In this neighborhood, the highest L_{dn} contribution from the MOWF would be 45 dBA, more than 18 dB less than noise from HSR train operations at that receptor. As a result, the additional noise from all of the MOWFs would not contribute to noise impacts on nearby sensitive receptors.

CEQA Conclusion

The impact under CEQA would be less than significant for all four project alternatives because the sound levels from the MOWFs would be substantially less than from HSR train operations. Therefore, the MOWFs would not contribute to or cause noise impacts. Therefore, CEQA does not require mitigation.

Impact NV#5: Intermittent Permanent Human Annoyance from Onset of Passing HSR Trains

Under all project alternatives, trains would reach maximum speeds of 220 mph in certain portions of the alignments with dedicated track. As shown on Figure 3.4-6, the onset rate of 30 dB/second would be experienced by receptors within 46 feet of the train when the train is operating at 220 mph and within 23 feet when the train is operating at 110 mph. For speeds between 110 mph and 220 mph, the onset rate of 30 dB/second would be experienced at distances between 23 and 46 feet from the train. For speeds less than 110 mph, the onset rate of 30 dB/second would be experienced at distances of less than 23 feet from the train.

The project's dedicated right-of-way would be a minimum of 85 feet wide. In addition, the dedicated segments are usually on viaduct or embankments instead of at-grade, which introduces additional vertical distance separation from sensitive receptors. As the distance for the startle effect for humans is 46 feet, it is expected that the distance in which startle effects would occur would be within the dedicated right-of-way. This would apply to Alternative 1 south of I-880, Alternatives 2 and 3 south of Scott Boulevard, and Alternative 4 south of Gilroy.

Under Alternative 1, blended operations would occur between Scott Boulevard and I-880, but the right-of-way is sufficiently wide that there are no noise-sensitive receptors within 23 feet of the planned track alignments.

Under Alternative 4, blended operations would occur between Scott Boulevard in Santa Clara and San Jose and Gilroy, with speeds up to 110 mph. Noise-sensitive receptors within 23 feet of the alignment would experience an onset rate of 30 dB/second. Between Scott Boulevard and the San Jose Diridon Station, there is extensive daily train traffic along the Caltrain Corridor, including Caltrain (92 daily trains), ACE (8 daily trains), Capitol Corridor (14 daily trains), Amtrak (2 daily trains), and freight (9 daily trains). Between the San Jose Diridon Station and Tamien Station, a moderate amount of daily train traffic operates along the Caltrain Corridor, including Caltrain (40 daily trains), ACE (8 daily trains), Amtrak (2 daily trains), and freight (4 daily trains). Between Tamien Station and Gilroy, there is limited existing daily train traffic along the Caltrain and UPRR corridors, including Caltrain (6 daily trains), Amtrak (2 daily trains), and freight (4 daily trains). At present, trains operate up to 79 mph in these areas.

Passengers may be on Caltrain or HSR platforms closer than 23 feet from the tracks. However, there would be advance warning of trains approaching with announcements, horns, bells, and

signage, so substantial, ongoing startle effects would not occur there with train passage. The same would be true at the at-grade crossings for vehicles, bicyclists, and pedestrians under Alternative 4.

Analysts reviewed the Alternative 4 alignment between Scott Boulevard in Santa Clara and Gilroy and found that in most areas (outside of stations and at-grade crossings), there would be more than 23 feet from the outermost track to sensitive noise receptors and no startle effects would occur. Analysts identified one noise-sensitive receptors within 23 feet of the Alternative 4 tracks (receptors in properties not immediately adjacent to the railroad right-of-way would not be affected):[12]

- Morgan Hill and Gilroy Subsection
  - In Morgan Hill, one mobile home east of Wright Avenue west of the right-of-way south of Butterfield Boulevard I, is within 23 feet of the proposed southbound track.

Based on the current tunnel design, roughly half of the sound generated in the tunnel would pass out through the portal, and the other half would propagate into the interior. The effect would be a rapid rise in sound level as the train leaves the tunnel and portal, forewarned by a propagating wave ahead of the train. Depending on the shape of the portal, shape of the train nose, and blockage ratio, the rate of pressure rise associated with rapid train movement can be substantial. The pressure wave front rate of rise is reduced by friction between the moving air column and tunnel wall, so that the pressure wave does not easily develop into a shock wave. This portal noise effect has been studied theoretically and experimentally and is well understood. However, as described in Chapter 2, Alternatives, attenuation of the portal noise would be achieved with long, flared portals and low blockage ratios. In-tunnel cross-passages and vents may also be utilized to reduce pressure magnitudes and rates of rise, though passage of these vents may generate additional propagating and steepening wave fronts. These tunnel and tunnel portal design features would be used to attenuate additional noise associated with the train entering or exiting a tunnel.

CEQA Conclusion

The impact under CEQA would be less than significant under Alternatives 1, 2, and 3 between San Jose and Gilroy, and under all project alternatives from Gilroy to the San Joaquin Valley, because the area where the startle effect could occur is within the HSR right-of-way, which would be fenced off from public access. Therefore, startle of adjacent sensitive receptors would not occur, and these alternatives would not result in the generation of noise levels in excess of standards for a severe impact established by the FRA. Therefore, CEQA does not require mitigation

Under all alternatives, at Caltrain or HSR stations, passengers may be on HSR platforms closer than 23 feet from the tracks but would have advance warning of trains approaching, so substantial, ongoing startle effects would not occur. The same would be true at the at-grade crossings for vehicles, bicyclists, and pedestrians under Alternative 4.

Under Alternative 4, one sensitive noise receptor was identified less than 23 feet from the nearest track; residents at that location would be initially startled by approaching trains traveling at up to 110 mph in areas where the receptors currently experience train passbys up to 79 mph and this is considered significant because the onset noise rate would exceed the identified threshold for sudden onset noise. Mitigation to address this impact is identified in Section 3.4.9, CEQA Significance Conclusions. Section 3.4.7, Mitigation Measures, describes the mitigation in detail.

Regarding tunnel portal noise, project tunnel and portal design included in the project description would attenuate noise pressure magnitudes and rate of rise and thus impacts relative to tunnel portal noise would be less than significant.

[12] If residences are proposed for acquisition, they are not included in the profile of potentially affected areas because residents would not be present during operations.

Impact NV#6: Permanent Exposure of Sensitive Receptors to Vehicular Traffic Noise Increases

In addition to noise from project operations, analysts evaluated noise from changes in vehicle traffic volume from existing conditions compared to those associated with the project at HSR stations and MOWFs for 2029 and 2040 No Project and Plus Project conditions. Alternative 2 would eliminate a number of existing at-grade crossings, but these are not expected to increase traffic volume. Monterey Road is the only major road that would be substantially reconfigured by the project, with a reduction of travel lanes from six to four lanes between Capitol Expressway and Blossom Hill Road.

Project operations would generate additional traffic and traffic-related noise under the 2029 Plus Project and 2040 Plus Project conditions when compared to the existing conditions. Volume 2, Appendix 3.4-A, provides the existing total average daily traffic volumes for each roadway segment under 2029 No Project and the 2029 Plus Project conditions for each project alternative, and calculates the noise increases over existing noise conditions and over the No Project Alternative. Table 3.4-18 summarizes the number of roadway segments with noise increases greater than or equal to 3 dB over existing conditions by alternative under the 2029 and 2040 Plus Project conditions.

Table 3.4-18 2029 and 2040 Plus Project Number of Roadway Segments with Traffic-Related Noise Increases More than 3 dBA above Existing Noise Conditions

Subsection and Roadway Segments	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	2029	2040	2029	2040	2029	2040	2029	2040
San Jose Diridon Station Approach Subsection								
San Jose Roadway Segments	4	5	4	5	4	5	3	4
Monterey Corridor Subsection								
Monterey Road Segments	1	4	1	4	1	4	2	4
Morgan Hill and Gilroy Subsection								
Monterey Road Segments	1	2	1	2	1	2	1	2
Downtown Gilroy Station Roadway Segments	0	0	0	0	0	0	0	1
East Gilroy MOWF Roadway Segments	0	0	0	0	0	1	0	0
South Gilroy MOWF Roadway Segments	1	1	1	1	0	0	0	1
Totals	**7**	**12**	**7**	**12**	**6**	**12**	**6**	**12**

dBA = A-weighted decibels
MOWF = maintenance of way facility

Permanent increases in traffic-related noise would be similar for all four project alternatives and would occur at roadways segments near San Jose Diridon Station, along Monterey Corridor, and near Gilroy. In 2029, seven roadway segments under Alternatives 1 and 2 and six roadway segments under Alternatives 3 and 4 have the potential for noise level increases greater than or equal to 3 dB compared to existing noise conditions. Except for one roadway segment under Alternatives 1, 2, and 4 near the South Gilroy MOWF and under Alternative 3 near the East Gilroy MOWF, these traffic-related noise increases would occur in San Jose. In 2040, project operations would result in 12 roadway segments with the potential for noise level increases greater than or equal to 3 dB; most of these traffic noise impacts would occur near the San Jose Diridon Station and along Monterey Road.

CEQA Conclusion

The impact under CEQA would be significant for all four project alternatives because increases in traffic associated with project operations would increase ambient noise levels in the project vicinity above levels existing without the project. Traffic noise level increases greater than or equal to 3 dB above existing levels would occur at roadway segments located primarily near the HSR stations and MOWFs. Seven roadway segments under Alternatives 1 and 2 and six roadway segments under Alternatives 3 and 4 would have the potential for noise level increases greater than or equal to 3 dB compared to existing noise conditions in 2029; by 2040, 12 roadway segments would have the potential for noise level increases greater than or equal to 3 dB under all four project alternatives. Mitigation to address this impact is identified in Section 3.4.9, CEQA Significance Conclusions. Section 3.4.7, Mitigation Measures, describes the mitigation in detail.

Impact NV#7: Intermittent Permanent Livestock Stress from Passing HSR Trains

The project would cross through rural, agricultural, and open space lands in southern Santa Clara, San Benito, and Merced Counties that include rangeland used by cattle and confined animal agricultural operations in the San Joaquin Valley.

The FRA guidance manual (FRA 2012) establishes an SEL of 100 dBA from a single train passby as the criterion for potential noise impacts on livestock. A noise screening assessment was conducted to determine typical and maximum distances from the proposed HSR tracks at which the limits may be exceeded.

Table 3.4-19 shows the results of the screening assessment. For HSR track at grade and on an embankment, the screening distances for potential impacts on livestock would be 15 feet from the track centerline for trains traveling at 110 mph, 25 feet from the track centerline for trains traveling at 150 mph, and 70 feet for trains traveling at 220 mph. At locations where the HSR would be on a 50-foot-high viaduct, the passby SEL of 100 dBA would not be surpassed beyond the edge of the aerial structure, approximately 15 feet from the track centerline.

Table 3.4-19 Screening Distances for Impacts on Livestock

HSR Configuration	Speed (mph)	SEL[1] (dBA)	Distance from HSR Centerline (feet)
HSR on at-grade track	110	100	15
	150	100	25
	220	100	70
HSR on 10-foot-high embankment	150	100	25
	220	100	70
HSR on 50-foot high viaduct[2]	150	88	15
	220	94	15
HSR on at-grade track, sounding warning horn	110	100	65
Caltrain on at-grade track, sounding warning horn	79	100	62
Freight train on at-grade track, sounding warning horn	60	100	290

[1] The SEL represents a receptor's cumulative noise exposure from an event normalized to a 1-second interval. This noise descriptor is used to assess impacts on livestock.
[2] The aerial structure projections assume a parapet barrier on the edge of the aerial structure 3 feet above the top of the rail. The distance from the track centerline where the SEL = 100 dBA is less than 15 feet.
HSR = high-speed rail
mph = miles per hour
SEL = sound exposure level
dBA = A-weighted decibel

At locations where the HSR would sound warning horns (e.g., at HSR stations under all alternatives and at the at-grade crossings and Caltrain stations under Alternative 4), the screening distance would be approximately 65 feet from the track centerline. For reference, screening distances were also calculated and added to Table 3.4-19 for a Caltrain train and a freight train passby sounding warning horns. The screening distances are 62 feet and 290 feet, respectively.

According to the screening distance information shown in Table 3.4-19, livestock might be within the screening distance for an at-grade location or 10-foot-high embankment HSR (i.e., within 70 feet of either side of the track centerline [for a total width of 140 feet]). Because fences control access to the right-of-way and the right-of-way would be a minimum of 85 feet wide, livestock would have to be within approximately 30 feet of the edge of the HSR right-of-way to experience noise impacts above the recommended threshold. Where livestock operations are adjacent to the HSR right-of-way, adverse impacts would occur within 30 feet of the HSR right-of-way.

Livestock may come within 30 feet of the right-of-way fence while foraging or trying to cross the project alignment using crossing structures for livestock. All project alternatives would cross rangeland used for cattle foraging whether on viaduct, embankment, or at grade. There are no current methods to measure the impacts on a species-by-species basis. However, in all areas that would be at-grade where the right-of-way and adjacent rangeland are used for livestock grazing, the project would expose livestock to noise levels that exceed the 100-dBA SEL threshold, which may elicit a startle, avoidance, or negative behavior by livestock. In most cases, livestock using rangeland could avoid noise stress by not foraging near the tracks. However, it is expected that because of the speed of the train and the short duration of any passbys, there would be livestock in this zone and noise impacts in this zone would be of short duration.

As described in Attachment 1 of Appendix D, High-Speed Rail Impacts on Confined Animal Agriculture Facilities of the *San Jose to Merced Project Section Community Impact Assessment* (Authority 2019b), several confined animal agriculture facilities are within 100 feet of the centerline of the project alignment in the San Joaquin Valley Subsection, and livestock animals within 30 feet of the right-of-way fence would be affected by train passbys. The figures in the Community Impact Assessment show confined animal agriculture facilities that would be affected by the alternatives. Livestock could avoid noise stress by staying away from the tracks. However, it is unlikely that livestock would have sufficient warning to move away from a passing train at speeds in excess of 200 mph, as would occur in the San Joaquin Valley Subsection. It is also unknown whether animals would choose to move. It is possible that animals in confined animal agricultural facilities may become habituated to train noise over time. While habituation has been shown as a common animal response to noise over time, there are limited studies to confirm the specific response of livestock to startle noise.[13]

Alternatives 1, 2, and 3 would be grade separated on dedicated tracks and thus no horn sounding would be necessary at any at-grade crossings or at Caltrain stations; therefore, no horn-sounding impacts on livestock would occur. Under Alternative 4, the project would sound horns at the at-grade crossings and Caltrain stations between San Jose and Gilroy. The urban areas of San Jose, Morgan Hill, Gilroy, the developed area of San Martin, and land adjacent to the Caltrain

[13] The Mineta Transportation Institute conducted a study of the effects of HSR noise on horses (Mineta Transportation Institute 2015) which concluded as follows: "…Loud noises are known to have the potential to startle horses, which may have various detrimental effects on their well-being and that of their riders. There are no precise criteria for the amount of noise required to create a startling effect, only rough estimates of the amount of noise that may startle them. Virtually no systematic research has been conducted to establish such criteria. The very few studies that seem most relevant—i.e., those that explicitly seek to address the link between noise and a response from equines—uniformly conclude that horses tend to "habituate" to regularly repeated noises. However, this response pattern appears not to have been subject to systemic testing with respect to the specific noise patterns produced by trains." The Authority evaluated the effects of noise on dairies in a 2012 white paper (Authority 2012a), which concluded as follows: "Many studies on domestic animals suggest that some species appear to adjust to some forms of sound disturbance. Conclusions from research conducted to date provide only rough estimates of threshold levels for observed animal disturbance. Cows on dairies are constantly exposed to a variety of noises from farm equipment, farm machinery, and work activities that may have habituated them to noises above the presumed threshold for response… While current research suggests minimal impact beyond 100 feet, this is not conclusive and consideration should be given to studies of cattle responses to the HST for conditions where cattle operations are within 350 feet (90 dB)."

stations provide limited to no access to livestock. Thus, potential horn-sounding impacts on livestock under Alternative 4 are limited to the rural area between San Jose and Morgan Hill (e.g., Coyote Valley) and the semirural area between San Martin and Gilroy. In these two areas, livestock would be sporadically within the screening distance for an HSR train sounding the warning horn at an at-grade crossing (i.e., within 65 feet of either side of the track centerlines), similar to livestock within the screening distances for existing Caltrain and freight sounding warning horn noise at the at-grade crossings. Horn sounding in these areas would increase in frequency, but horn intensity would not increase over current levels.

There are no dairies or rangeland along the DDV, so there would be no effect on livestock due to noise changes with increased speed. There may be livestock in agricultural or rangeland along the aboveground portions of the TDV. However, the increase of train speeds along the TDV from 200 mph to 220 mph would not substantially change the level of noise effects on livestock. The above screening assessment was conducted for train speeds up to 220 mph in the San Joaquin Valley Subsection; accordingly, any increase in train speeds along the TDV from 200 mph to 220 mph falls within the screening assessment.

CEQA Conclusion

The impact under CEQA would be less than significant for all four project alternatives because noise from passbys would be temporary and brief. Confined animals may also become habituated to train noise. Livestock in two areas between San Jose and Gilroy would experience additional horn soundings with Alternative 4, but the horn soundings would be similar to existing train horn noise and are not expected to result in substantial new stress compared to existing conditions. No new significant impacts would be experienced by any livestock in agricultural or rangeland along the aboveground portions of the TDV where train speeds would increase from 200 mph to 220 mph. Therefore, CEQA does not require mitigation.

Impact NV#8: Permanent Exposure of Sensitive Receptors to Traction Power Facility Noise

Analysts identified potentially affected noise sensitive receptors using the screening distance of 250 feet for receptors with an unobstructed view to the facilities and 125 feet for those with intervening buildings. FTA reference levels were used to calculate the total project noise level with substations and train operations at the receptors identified within the screening distance.

Train operational noise levels were also calculated using the methodology in Section 3.4.4.3, Methods for Impact Analysis, to compare the total project noise levels with the ambient noise at the receptors and to account for both changes from project operations and the new substation or facility noise source. Table 3.4-20 shows the number of receptors potentially affected by noise. The highest noise levels from ancillary facilities would be 70 L_{dn} dBA at 110 feet, which would generate a severe noise impact at the substation facility alone. However, in combination with the train operations, the substation noise would not generate any additional impact beyond those shown in Table 3.4-16. Furthermore, this analysis is conservative because distances were based on the closest outer footprint of facility, and the specific distance to noise sources would be greater in many cases.

Table 3.4-20 Traction Power Facility Noise Analysis—Number of Affected Receptors

City	Substation Facility[1]	Land Use Category[2]	Alt 1		Alt 2		Alt 3		Alt 4	
			Mod	Sev	Mod	Sev	Mod	Sev	Mod	Sev
San Jose	Paralleling Station	2	0	0	0	0	0	0	0	30
Morgan Hill	Paralleling Station	2	1	5	0	0	1	5	0	0

City	Substation Facility[1]	Land Use Category[2]	Alt 1		Alt 2		Alt 3		Alt 4	
			Mod	Sev	Mod	Sev	Mod	Sev	Mod	Sev
Gilroy	Switching Station	2	0	0	0	0	0	0	0	2
	Paralleling Station	1 2	0	0	0	0	0 0	1 1	0	0
Hollister	Paralleling Station[3]	2	0	0	0	0	0	0	0	0
Gilroy	TPSS Site 4	2	0	1	0	1	0	1	0	1
Total			**1**	**6**	**0**	**1**	**1**	**8**	**0**	**33**

[1] Facilities not listed have no noise-sensitive receptors within 250 feet of the facility.
[2] FRA Land Use Categories are summarized in Table 3.4-5. Land Use Category 1 = Areas where quiet is an essential element to the land use; Category 2 = Residential; Category 3 = Institutional use and passive-use parks.
[3] Take: property would be acquired by the Authority; buildings not counted.
Alt = Alternative
Mod = moderate
Sev = severe
TPSS =traction power supply substation

CEQA Conclusion

The impact under CEQA would be significant for all alternatives when combined with the operational train noise impacts that exceed FRA criteria. Under Alternative 4, the combined train and traction power paralleling station operations would generate severe noise impacts at 30 apartment residences in San Jose. The highest impacts would occur under Alternative 4, followed by Alternative 3 and then Alternative 1, with Alternative 2 having the fewest impacts. The difference in substation noise impacts between the project alternatives is predominantly the result of the placement of switching station or paralleling station sites near sensitive receptors; the Alternative 4 San Jose traction power paralleling station would be directly adjacent to a large multifamily apartment building. Mitigation to address this impact is identified in Section 3.4.9, CEQA Significance Conclusions. Section 3.4.7, Mitigation Measures, describes the mitigation in detail.

3.4.6.3 Vibration

Construction and operations of the project alternatives would result in temporary and permanent impacts from vibration. Construction of the new tracks, stations, and MOWFs would result in vibration impacts from blasting, pile driving, vibratory compaction, demolition, or excavation near vibration-sensitive structures. Train movement during operations of the project alternatives would increase vibration levels near the alignment right-of-way and also cause impacts.

No Project Conditions

The conditions describing the No Project Alternative are the same as those described in Section 3.4.6.2, Noise. The same planned development and transportation projects would generally result in increases in background vibration levels and could cause localized vibration impacts. Without the project alternatives, the Caltrain PCEP is assumed to use EMU vehicles in place of the current diesel locomotive-hauled coaches. The vibration analysis for the PCEP assumed that the EMU vehicle would be similar to the existing vehicles regarding vibration (Wilson Ihrig 2014). Thus, no new vibration impacts are assumed associated with PCEP without the project, because although there could be increases in other passenger or freight train operations, those operations would not be expected to cause higher vibration levels than the existing conditions.

Project Impacts

Construction Impacts

Project construction would involve demolition of existing structures, clearing and grubbing; handling, storing, hauling, excavating, and placing fill; pile driving; and construction of aerial structures, bridges, road modifications, utility upgrades and relocations, HSR electrical systems, and railbeds. Section 2.11, Construction Plan, describes construction activities.

Impact NV#9: Temporary Exposure of Sensitive Receptors and Buildings to Construction Vibration

Construction of project alternatives would require the use of equipment that would generate temporary ground-borne vibration during the 5-year construction period, with up to 2 years of continuous construction activity anticipated at any one location. The impacts from construction vibration would be the same under all project alternatives.

Human annoyance occurs when construction vibration rises above the threshold of human perception for extended periods. A threshold of 80 VdB has been used to evaluate nighttime annoyance for infrequent events at residential land use. This threshold is typically applied to most HSR construction work. For sources such as pile driving, vibratory compaction, and ongoing demolition work with jackhammers or hoe-rams, the frequent event criterion of 72 VdB has been used. Nighttime annoyance would potentially occur as far out as 300 feet from pile driving, 140 feet from vibratory compaction, and as close as 50 feet from short-duration, transient events. These activities could occur under any of the project alternatives, but are more likely to occur under Alternative 4. The amount of construction effort for the design variants would be approximately the same as the alternatives without the DDV and TDV, and thus construction generation of vibration would be approximately the same. Pile driving may occur on bridge retrofit structures along the DDV. The only bridge structure work where the alignment may shift with the DDV is the Julian Street overpass. The DDV would only shift construction closer to sensitive receptors north of Julian Street. There are three residences along Julian Street that would be within 300 feet of the Julian Street bridge work with the DDV; the closest residence would be about 185 feet from the Julian Street bridge work. Night-time annoyance due to pile driving could increase slightly in intensity as the work may be approximately 20 feet closer to these three residences with the DDV compared to Alternative 4 without the DDV. Other construction would not result in vibration levels above the annoyance threshold for these residences.

Building damage occurs when construction activities produce vibration in the ground that is strong enough to potentially cause cosmetic or structural damage. Pile driving very close to buildings (within 50 feet) would potentially exceed the 0.2 inch/second PPV threshold and cause building damage at wood-framed residential buildings with plaster. For modern, reinforced concrete buildings, building damage would potentially exceed the 0.5 inch/second PPV threshold within 30 feet. There are two modern, reinforced concrete buildings within 30 to 50 feet of construction of the Julian Street overpass under Alternative 4 with the DDV. The nearest building would be demolished as part of the DDV construction (and thus would not be damaged by vibration), and the second building is more than 30 feet from the overpass construction area with the DDV. Thus, no additional building damage due to pile-driving vibration during construction is expected. The TDV is in the same location as the alternatives without the TDV and thus would not change construction vibration effects on any receptors. Pile driving would occur on bridge retrofit structures and some aerial structure foundation support for any of the project alternatives.

Construction of bored tunnels in the Pacheco Pass Subsection would require the use of a tunnel-boring machine (TBM). Ground-borne TBM vibration is often imperceptible to humans at distances greater than 100 feet, and the mechanisms by which it travels through the ground are similar to those of ground vibration from train operations. Vibration from the TBM would vary with the diameter of the tunnel being constructed; a bigger TBM would create greater vibration than a smaller TBM. At slant distances (measured along a direct line from the TBM to a receptor of interest) of less than 100 feet, the likelihood of perceptibility increases, and overall vibration levels might be expected in the range of 72 VdB to 80 VdB. In this range, a person in an occupied building could be aware of the vibration from the TBM, but because the TBM would be moving through the tunnel, the vibration may only last for approximately a day. At the residential building nearest to the project alignment in Pacheco Pass, on Whiskey Flat Road, the tunnel depth would be greater than 200 feet. At that distance, it is not anticipated that vibration from the TBM would be perceptible.

Key construction differences are discussed under Impact NV#1 in Section 3.4.6.2, Noise, and Table 3.4-14. For the Morgan Hill and Gilroy Subsection, construction of the viaduct structure with cast-in-drilled-hole piles (Alternatives 1 and 3) would generally have a shorter criterion distance than the embankment and at-grade track options (Alternatives 2 and 4) because vibratory compaction would not be as widespread. For the San Jose Diridon Approach and Monterey Corridor Subsections, the aerial viaduct (Alternatives 1 and 3) similarly would have a shorter criterion distance than Alternatives 2 and 4. Nighttime construction would be required under Alternative 4 to minimize disruption with existing passenger rail services.

CEQA Conclusion

The impact under CEQA would be significant for all four project alternatives, with and without the DDV and TDV, because project construction would expose persons or buildings to excessive ground-borne vibration if pile driving would occur within 50 feet of any building. The alternatives would include NV-IAMF#1 to minimize construction vibration and the potential for it to cause damage to buildings and human annoyance. However, even with NV-IAMF#1, some sensitive receptors and buildings will be exposed to ground-borne vibration that will result in nighttime annoyance (Alternative 4) or building damage (all project alternatives). Mitigation to address this impact is identified in Section 3.4.9, CEQA Significance Conclusions. Section 3.4.7, Mitigation Measures, describes the mitigation in detail.

Operations Impacts

Project operations would include trains along the Caltrain Corridor servicing passengers at the San Jose Diridon and Gilroy Stations. Trains would also run regularly to MOWFs for maintenance. Chapter 2, Alternatives, describes operations and maintenance activities.

Impact NV#10: Intermittent Permanent Exposure of Sensitive Receptors to Vibration from Operations

Potential vibration impacts from project operations were assessed for 2040. Project operations would entail fewer trains per day in 2029 than in 2040, but the maximum operating speeds would be the same, so the maximum vibration levels would be the same for both 2029 and 2040 Plus Project conditions. Thus, the vibration impact assessment was conducted for only the 2040 Plus Project condition. Under the No Project Alternative, the Caltrain PCEP is assumed to use EMU vehicles in place of the current diesel locomotive-hauled coaches. The vibration analysis for the Caltrain PCEP conservatively assumed that the EMU vehicle would generate vibration similar to the existing vehicle (Wilson Ihrig 2014). Thus, no new vibration impacts are assumed associated with PCEP.

Table 3.4-21 summarizes the results of the vibration impact assessment by project alternative. Alternative 1 would result in 81 vibration impacts, Alternative 2 would result in 143 vibration impacts, Alternative 3 would result in 140 vibration impacts, and Alternative 4 would result in 1,203 vibration impacts. Most vibration impacts would occur within the Monterey Corridor Subsection, with the remaining vibration impacts occurring in the San Jose Diridon Station Approach and Morgan Hill and Gilroy Subsections. There are no vibration impacts in the Pacheco

Pass and San Joaquin Valley Subsections under any of the project alternatives. The Authority also analyzed the DDV and TDV design relative to vibration effects and found no change to the vibration impact assessment for the alternatives with the DDV and TDV. This is because the minor shifts in alignment and speed would cause changes in vibration levels that are too small to affect the impact assessment results.

Table 3.4-21 2029 and 2040 Plus Project Potential Vibration Impacts

Subsection	Number of Vibration Impacts				
	Land Use Category[1]	Alternative 1	Alternative 2	Alternative 3	Alternative 4
San Jose Diridon Station Approach	2	19	78	78	201
	1, 3	0	0	0	2
Monterey Corridor	2	62	63	62	581
	1, 3	0	0	0	2
Morgan Hill and Gilroy	2	0	1	0	416
	1, 3	0	1	0	1
Pacheco Pass	2	0	0	0	0
	1, 3	0	0	0	0
San Joaquin Valley	2	0	0	0	0
	1, 3	0	0	0	0
Subtotal	**2**	**81**	**142**	**140**	**1,198**
	1, 3	**0**	**1**	**0**	**5**
Total	**1, 2, 3**	**81**	**143**	**140**	**1,203**

[1] FRA Land Use Categories are summarized in Table 3.4-5. Land Use Category 1 = areas where quiet is an essential element to the land use; Category 2 = Residential; Category 3 = Institutional use and passive-use parks.

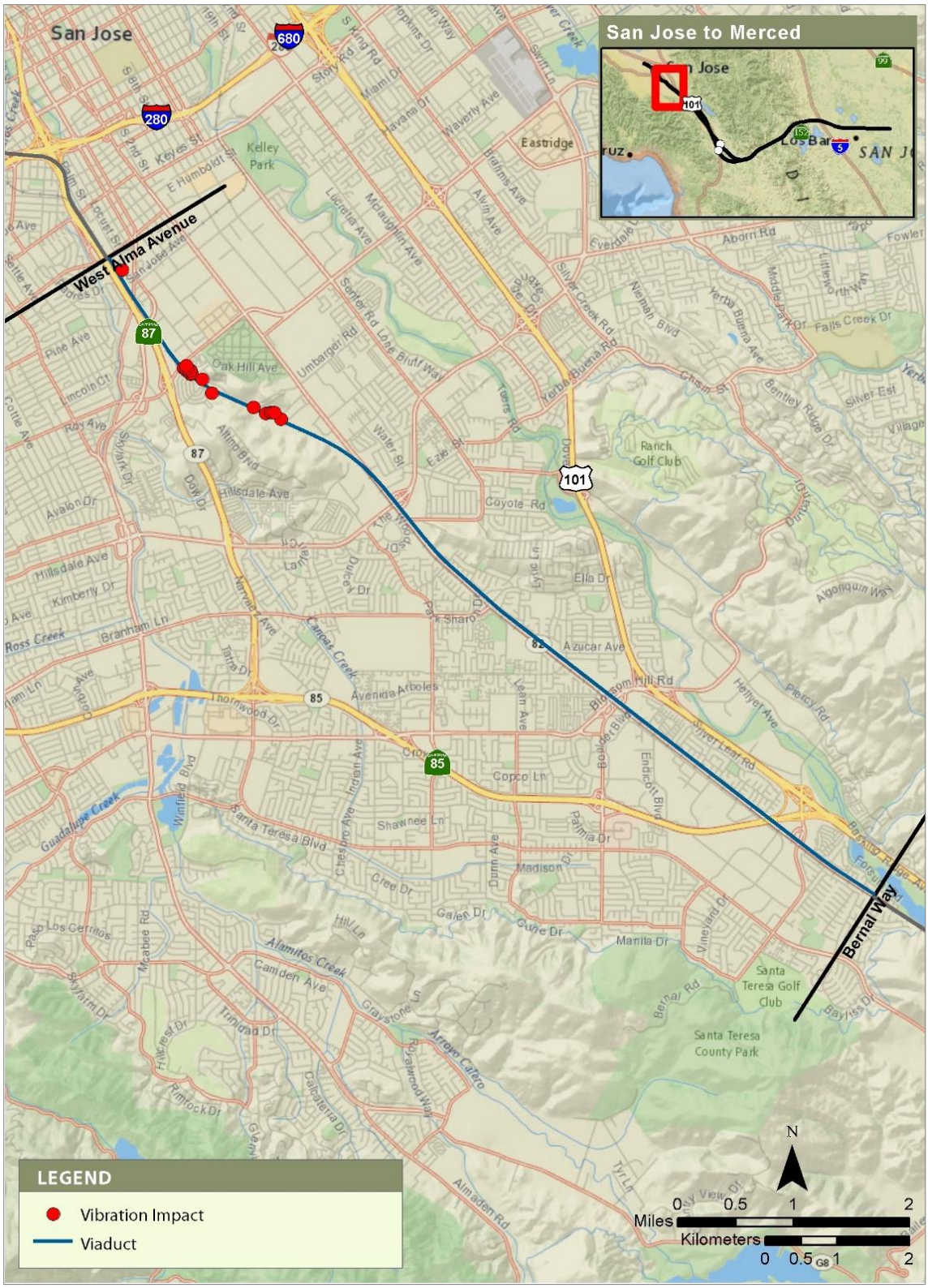
These vibration impacts are caused by both HSR train operations and, in some cases, Caltrain operations. Where the HSR project causes Caltrain and freight tracks to be shifted closer to vibration-sensitive buildings, the train operations on those closer tracks are treated as project vibration sources and compared to the impact criteria. Under Alternative 4, the vibration analysis assumes that Caltrain trains may operate at increased speeds (e.g., matching speeds for HSR along the shared sections) to accommodate blended service. Those Caltrain operations at higher speeds are treated as project vibration sources and compared to impact criteria.

The potential vibration impacts for each project alternative in the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections are illustrated on Figure 3.4-22 through Figure 3.4-31. Figure 3.4-22 and Figure 3.4-23 illustrate the Alternative 1 vibration impact locations, Figure 3.4-24 through Figure 3.4-26 illustrate the Alternative 2 vibration impact locations, Figure 3.4-27 and Figure 3.4-28 show the Alternative 3 locations, and Figure 3.4-29 through Figure 3.4-31 show the Alternative 4 locations. Each red dot indicates a cluster of receptors predicted to have a potential vibration impact. There are no vibration impacts in the Pacheco Pass and San Joaquin Valley Subsections under any of the project alternatives.

In the San Jose Diridon Station Approach and Monterey Corridor Subsections, there are many vibration-sensitive locations where the existing levels exceed the residential criterion of 72 VdB. Caltrain trains are the dominant existing rail source of vibration in the RSA, because Caltrain speeds exceed those of freight trains and vibration levels increase with speed.

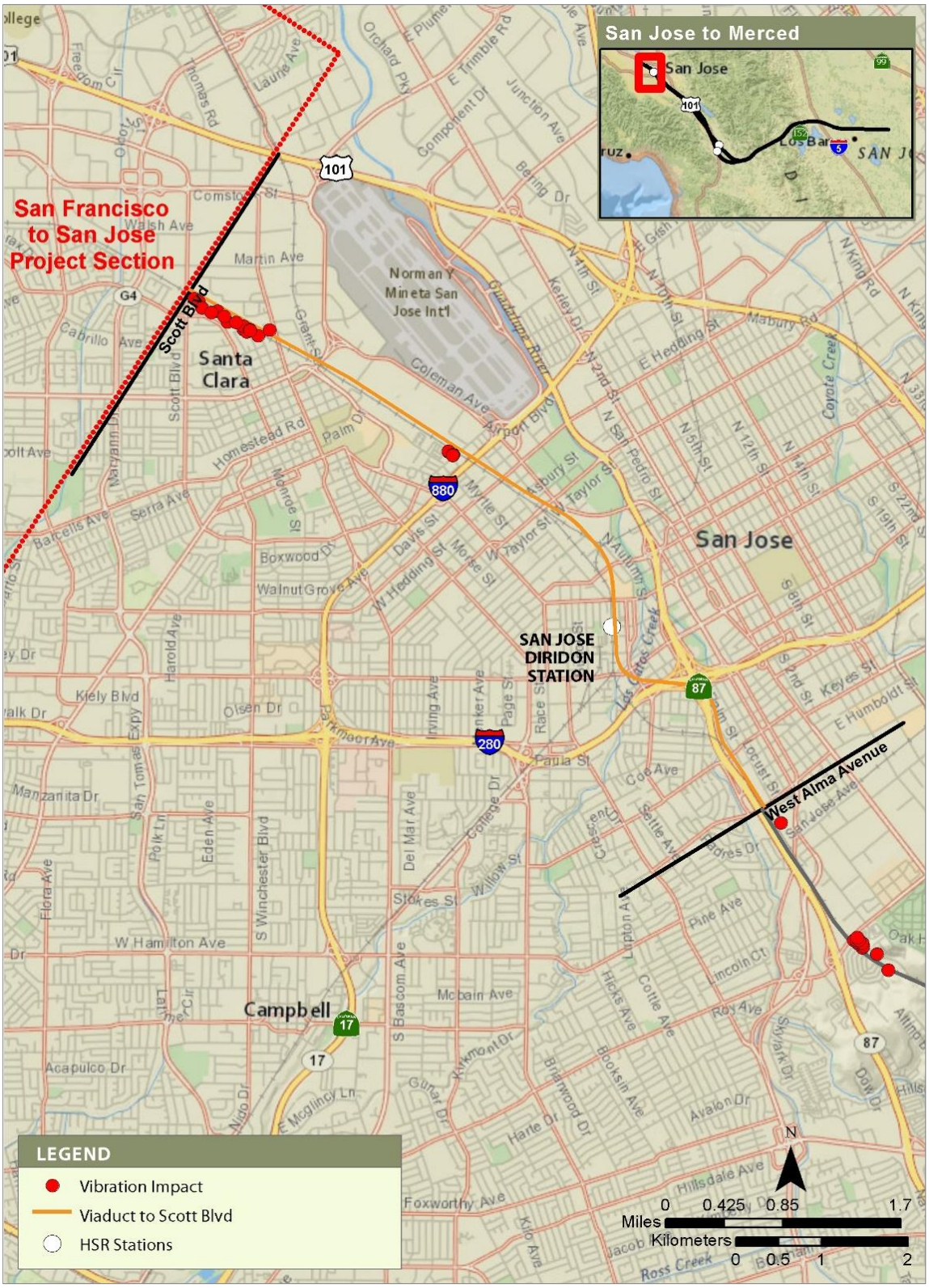
FEBRUARY 2019

Figure 3.4-22 2029 and 2040 Plus Project Vibration Impacts—Alternative 1 (San Jose Diridon Station Approach Subsection)



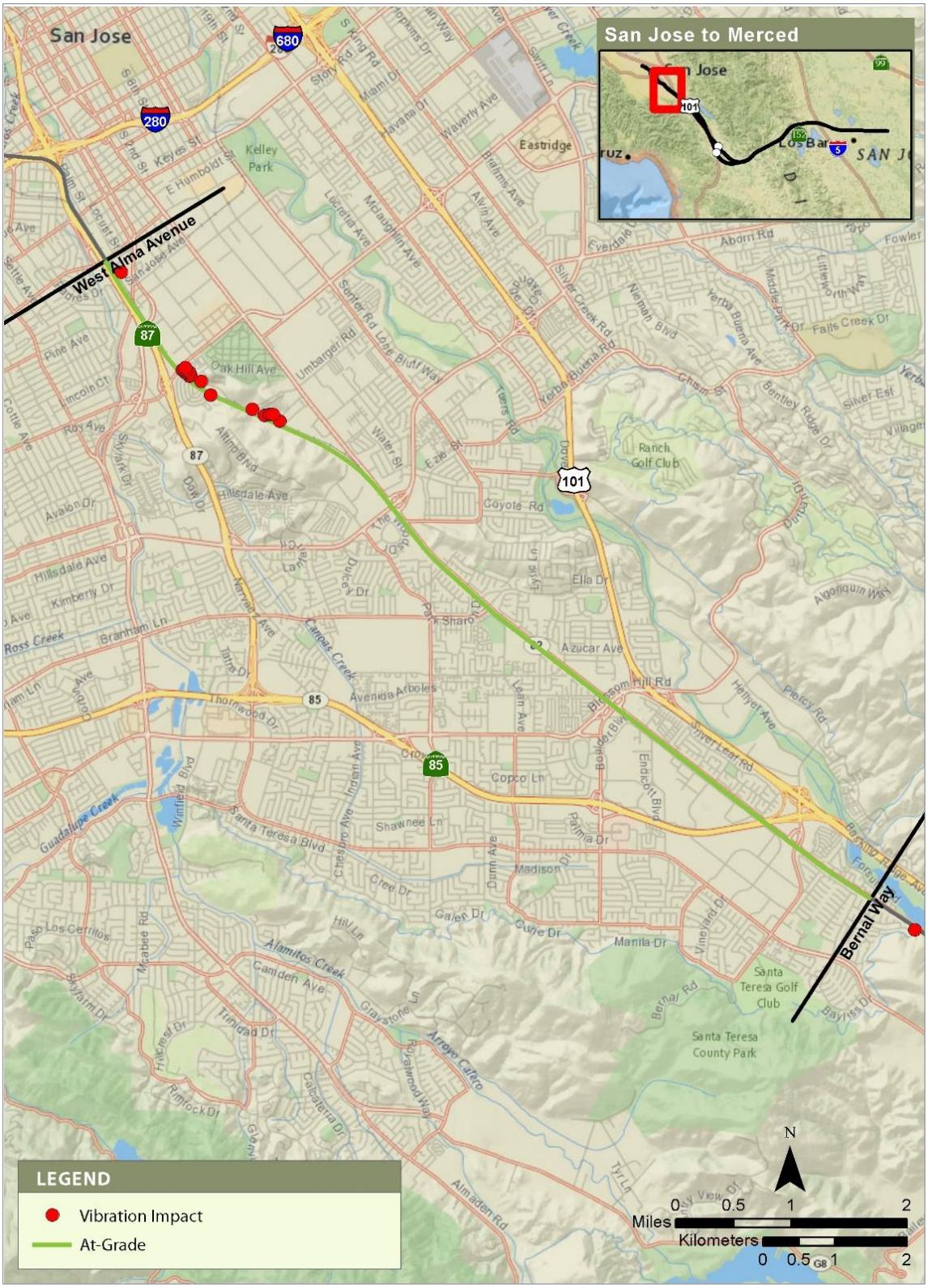
FEBRUARY 2019

Figure 3.4-23 2029 and 2040 Plus Project Vibration Impacts—Alternative 1 (Monterey Corridor Subsection)



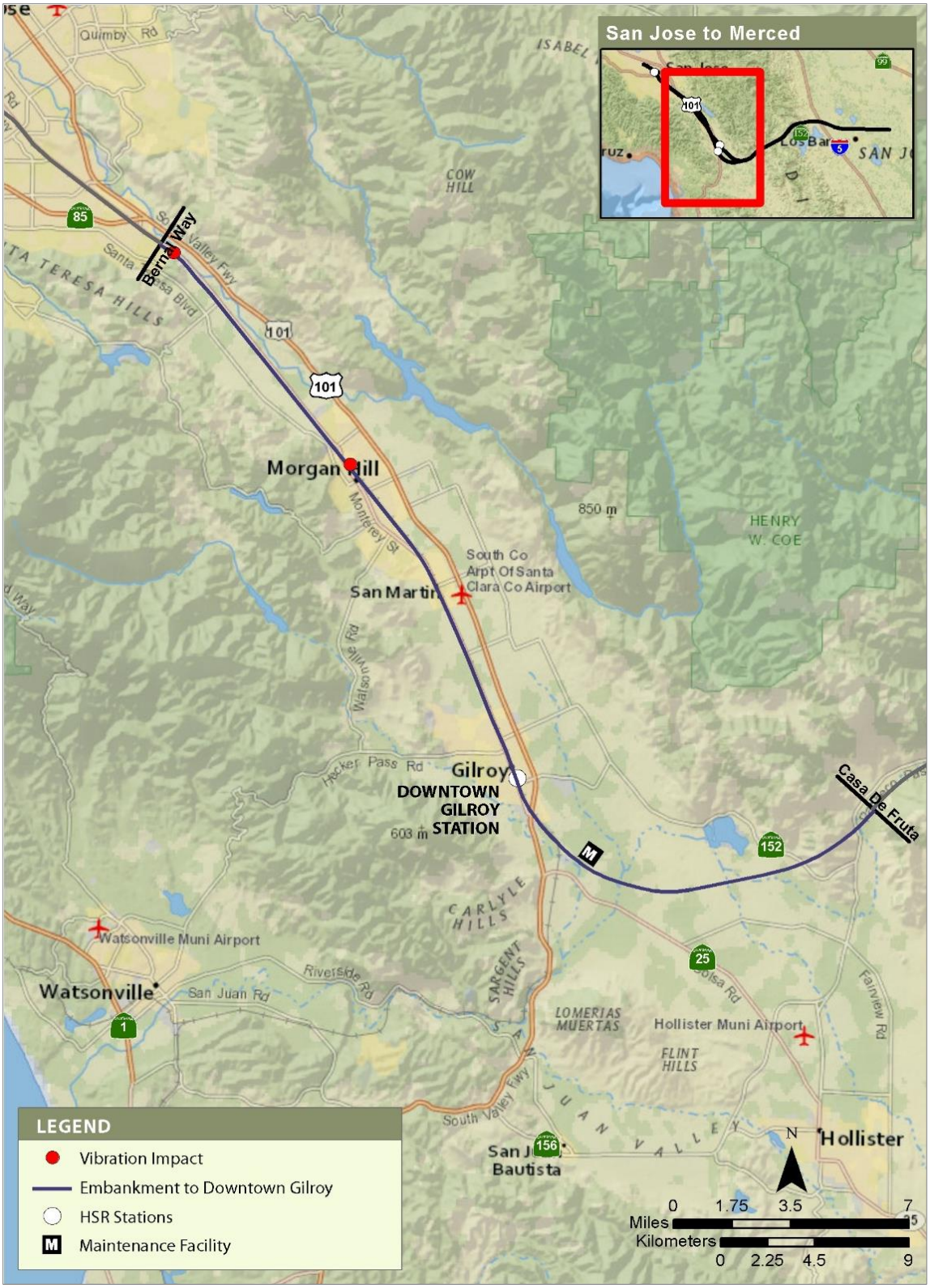
FEBRUARY 2019

Figure 3.4-24 2029 and 2040 Plus Project Vibration Impacts—Alternative 2 (San Jose Diridon Station Approach Subsection)



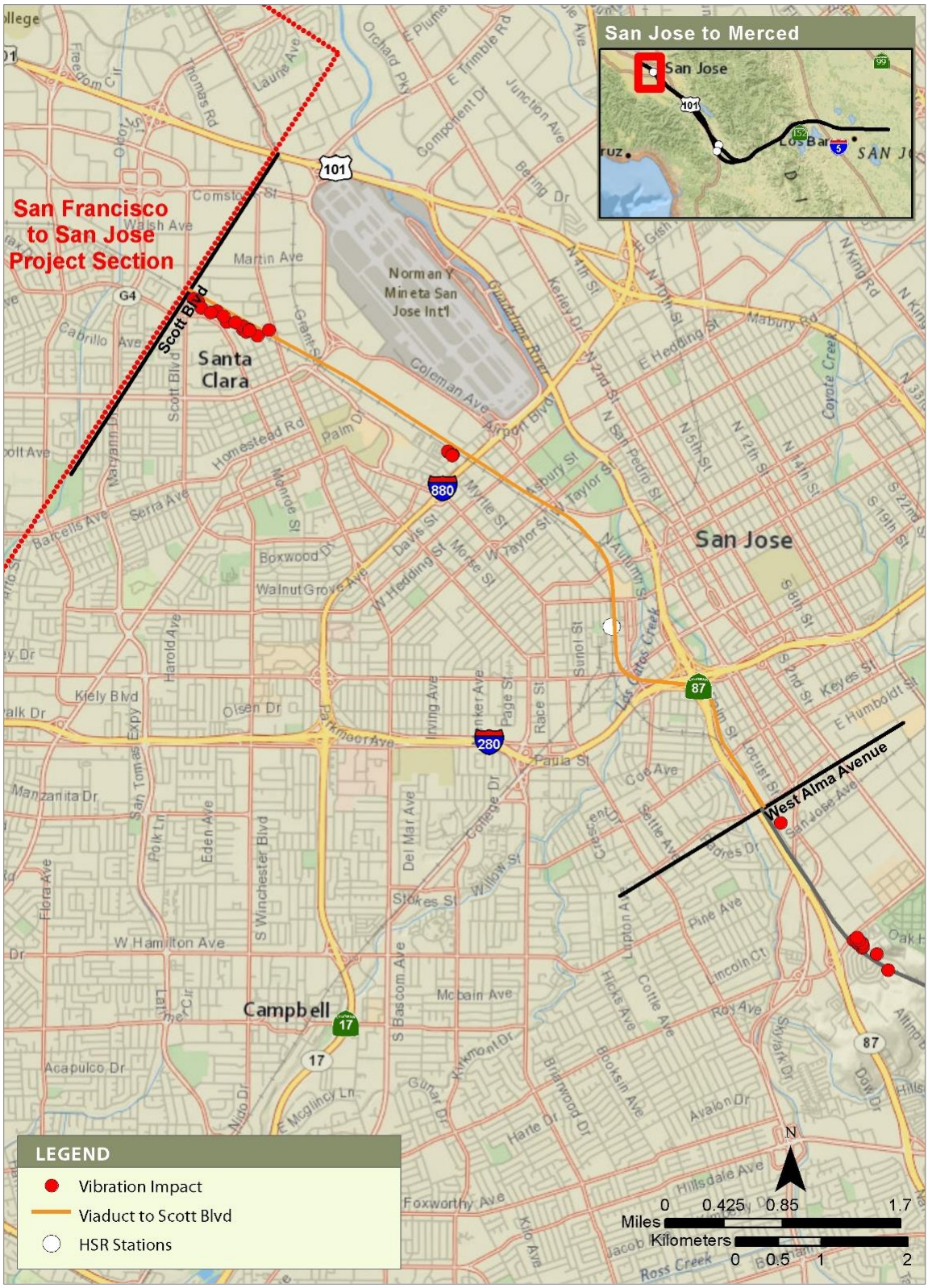
FEBRUARY 2019

Figure 3.4-25 2029 and 2040 Plus Project Vibration Impacts—Alternative 2 (Monterey Corridor Subsection)



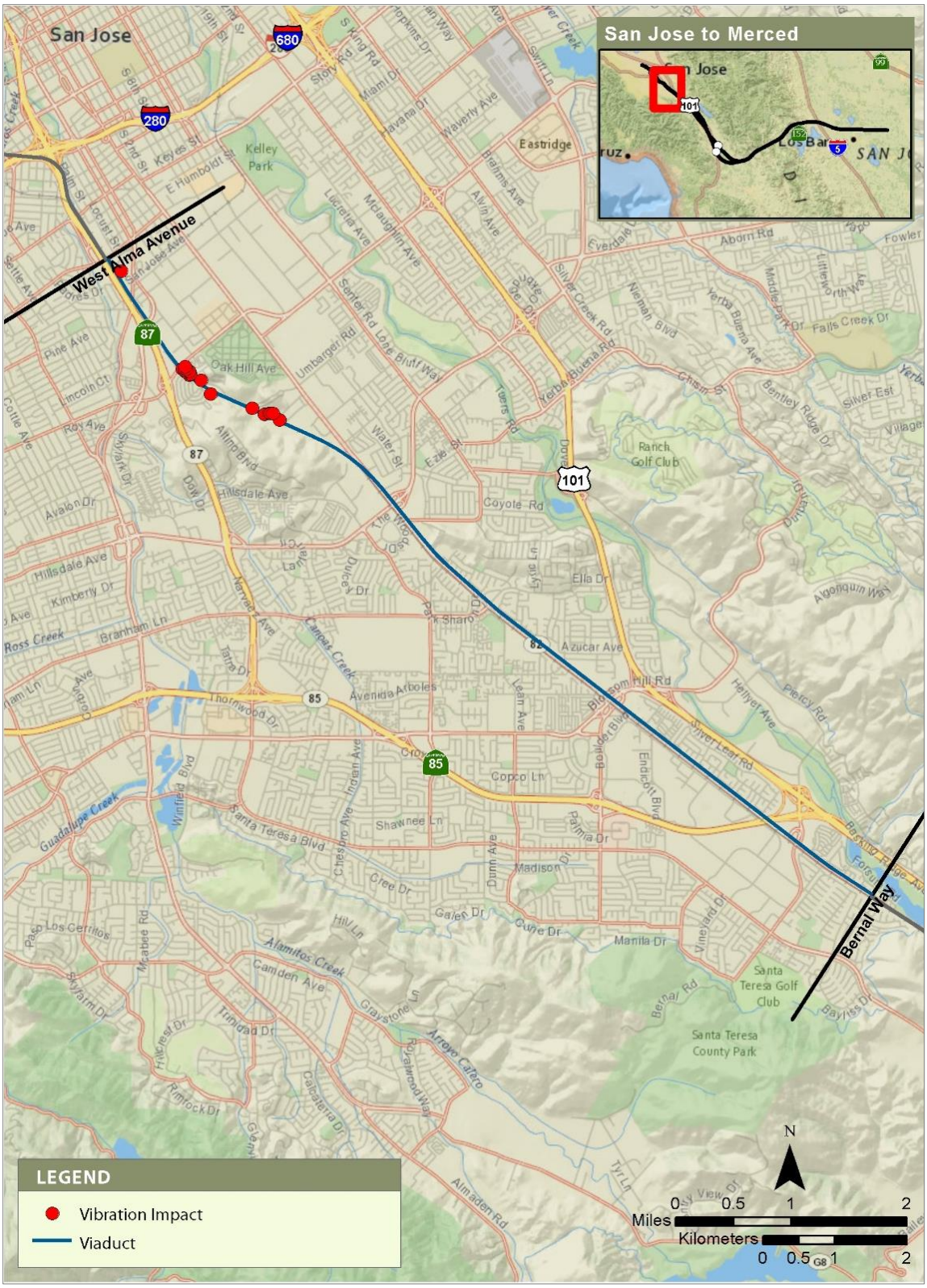
FEBRUARY 2019

Figure 3.4-26 2029 and 2040 Plus Project Vibration Impacts—Alternative 2 (Morgan Hill and Gilroy Subsection)



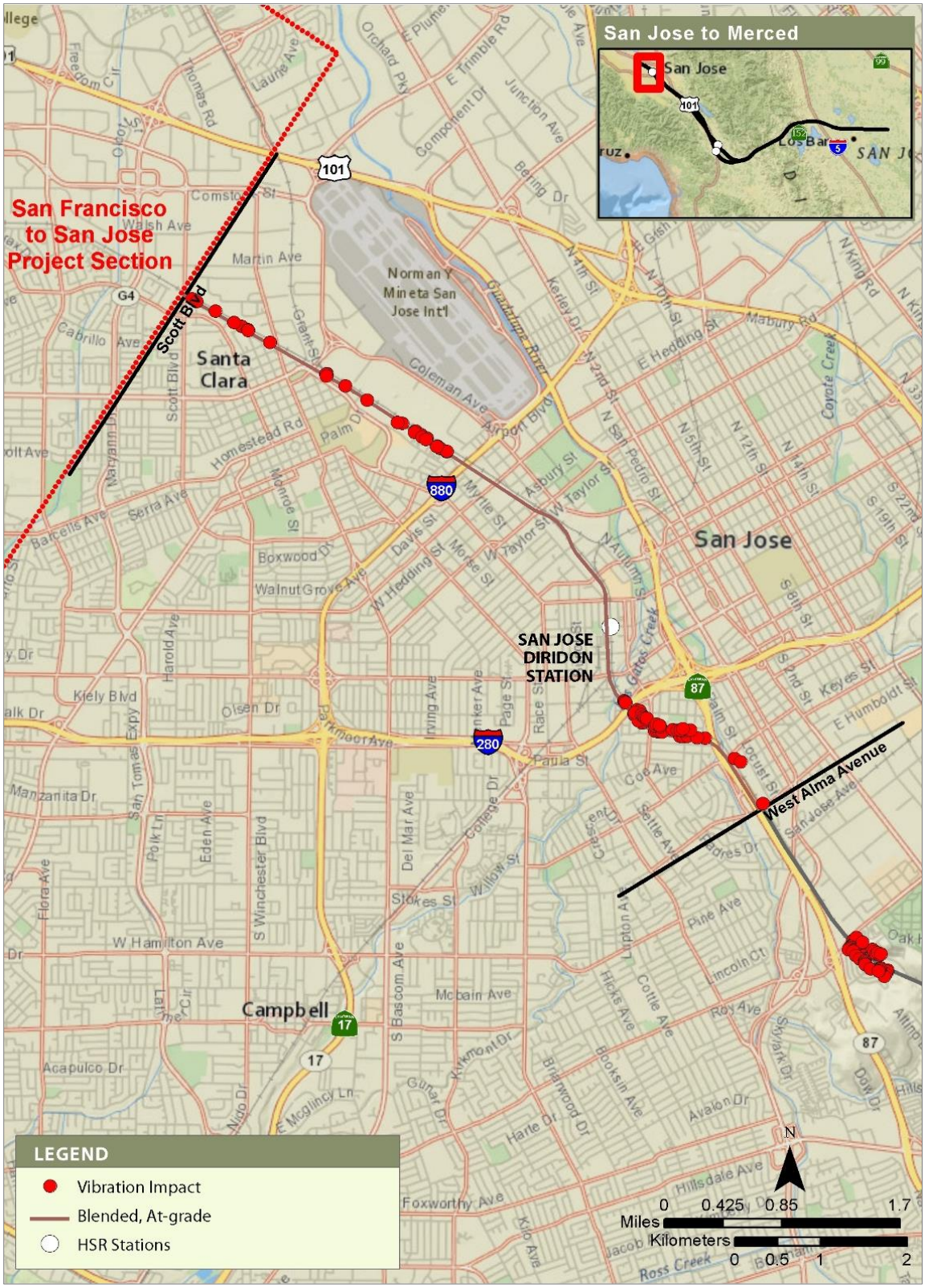
FEBRUARY 2019

Figure 3.4-27 2029 and 2040 Plus Project Vibration Impacts—Alternative 3 (San Jose Diridon Station Approach Subsection)



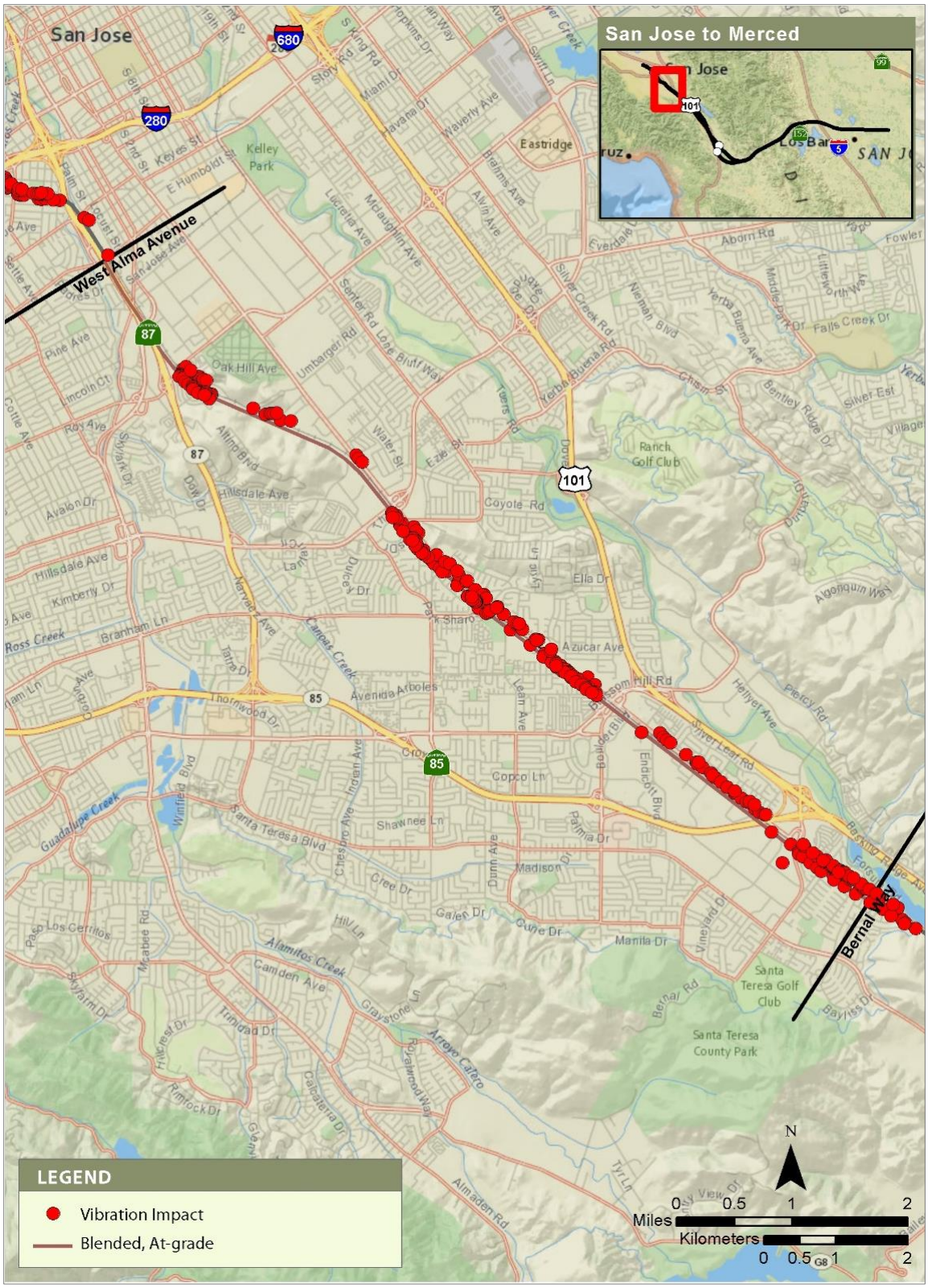
FEBRUARY 2019

Figure 3.4-28 2029 and 2040 Plus Project Vibration Impacts—Alternative 3 (Monterey Corridor Subsection)



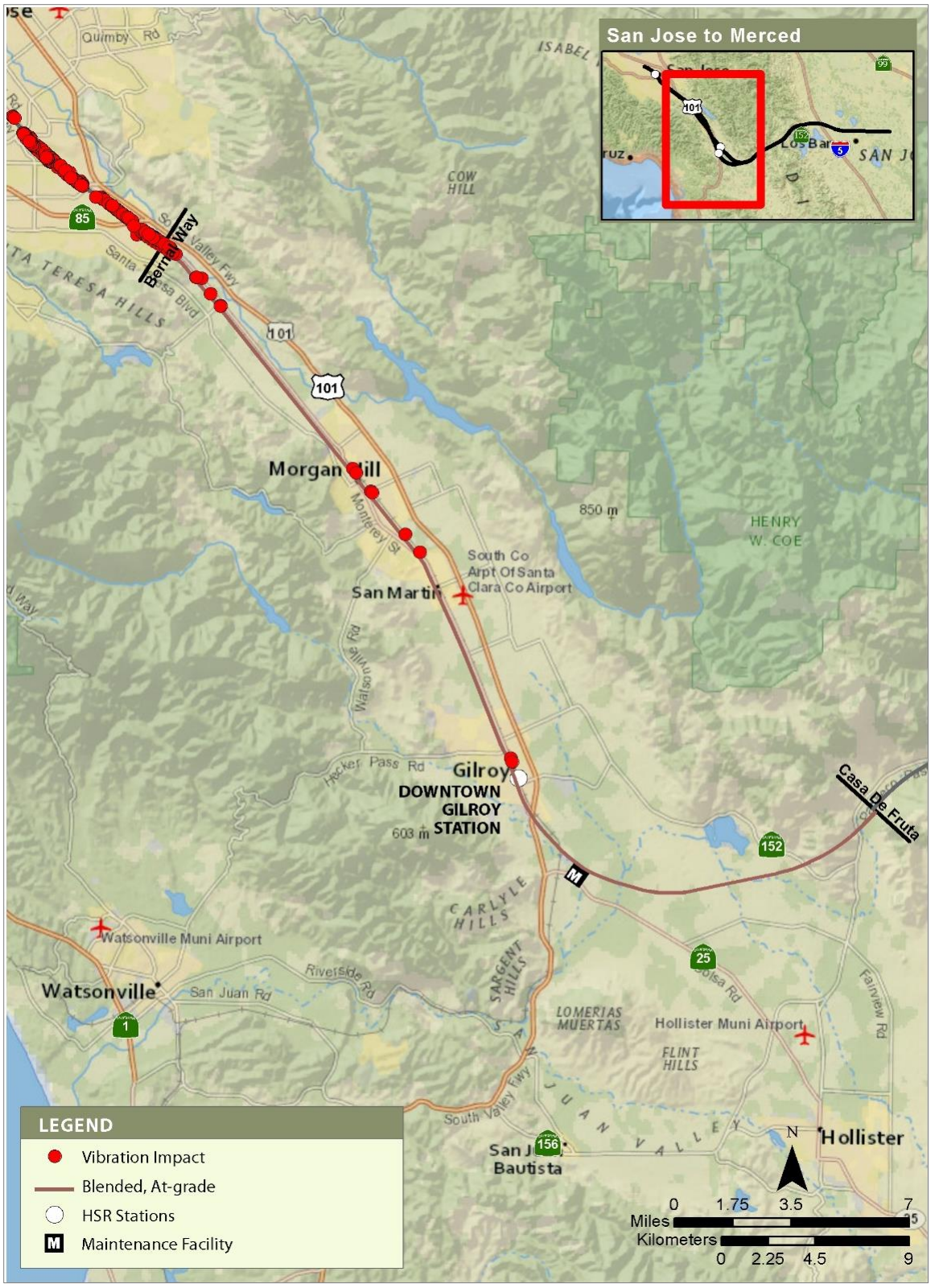
FEBRUARY 2019

Figure 3.4-29 2029 and 2040 Plus Project Vibration Impacts—Alternative 4 (San Jose Diridon Station Approach Subsection)



FEBRUARY 2019

Figure 3.4-30 2029 and 2040 Plus Project Vibration Impacts—Alternative 4 (Monterey Corridor Subsection)



FEBRUARY 2019

Figure 3.4-31 2029 and 2040 Plus Project Vibration Impacts—Alternative 4 (Morgan Hill and Gilroy Subsection)

Throughout most of the RSA, the projected vibration levels from HSR trains would be below the impact criterion and typically lower than the slower Caltrain trains. Much of Alternatives 1 and 3 would be on viaduct, and vibration levels from HSR trains on aerial structure are assumed to be 10 VdB lower than HSR trains at grade or on embankments. Even though the HSR train speeds are much higher than conventional-speed commuter rail such as Caltrain, the ground-borne vibration levels are often comparable or lower. This is likely because of the relatively low input forces from the HSR trains (the force density level[14]). To operate trains at very high speeds, the rails and wheels typically have to be in very good condition, resulting in lower vibration levels.

Under Alternative 4, HSR trains between San Jose and Gilroy would operate on tracks that are shared with Caltrain, which increases the likelihood that the rail roughness would increase with time and potentially lead to increased vibration levels. To account for this, an added engineering factor of 5 VdB has been added to the HSR vibration predictions where blended service would occur under Alternative 4.

Analysts identified four Category 1 vibration-sensitive facilities in the RSA, and potential impacts at each are described in the following paragraphs. The FRA general assessment impact criterion of 65 VdB for Category 1 vibration-sensitive facilities was used to assess impact at these buildings because it is not known what specific equipment is in the buildings, or where that sensitive equipment is located in the buildings. Therefore, the general assessment criterion is used to provide a conservative assessment of potential impact. Though the specific vibration-sensitive equipment at these facilities is not known, the projected maximum vibration level in any 1/3-octave band is provided for future reference (Volume 2, Appendix 3.4-A, provides more details).

The Great Oaks Research Park would be approximately 180 feet from the nearest HSR track in the Monterey Corridor Subsection under Alternative 4, and approximately 250 feet from the nearest HSR track under Alternatives 1, 2, and 3. The maximum projected vibration levels from HSR trains at the Great Oaks Research Park would be approximately 52 VdB under Alternatives 1 and 3, 64 VdB under Alternative 2, and 69 VdB under Alternative 4. With Alternatives 1 and 3, the maximum vibration level in any 1/3-octave band is predicted to be approximately 47 VdB. With Alternative 2, the maximum vibration in any 1/3-octave band is predicted to be approximately 58 VdB. With Alternative 4, the maximum vibration in any 1/3-octave band is predicted to be approximately 63 VdB. A vibration impact on this facility is predicted with Alternative 4, but not with the other alternatives.

Two vibration-sensitive facilities were identified in the Morgan Hill and Gilroy Subsection under Alternatives 2 and 4—Paramit Manufacturing and the Butterfield Professional Center—both between Tilton and Tennant. The Paramit Manufacturing building would be approximately 215 feet from the nearest HSR track under Alternative 2 and approximately 320 feet from the nearest HSR track under Alternative 4. The maximum projected overall vibration levels from HSR trains would be approximately 56 VdB; therefore, no vibration impact is predicted. The maximum vibration level in any 1/3-octave band is predicted to be approximately 49 VdB. The Butterfield Professional Center building is approximately 75 feet from the nearest HSR track under Alternative 2 and approximately 150 feet from the nearest HSR track under Alternative 4. The maximum projected overall vibration levels from HSR trains would be 60 VdB under Alternative 4 and 65 VdB under Alternative 2; therefore, vibration impact is predicted at the Butterfield facility under Alternative 2. The maximum vibration level in any 1/3-octave band is predicted to be approximately 59 VdB.

The St. Louise Regional Hospital would be more than 1,000 feet from the nearest HSR track under Alternative 3. The maximum projected vibration levels would be less than 50 VdB; therefore, no vibration impact is predicted.

The maximum vibration level in any 1/3-octave band is predicted to be less than 50 VdB. In the areas categorized as a heavily used rail corridor in the San Jose Diridon Station Approach

[14] The force density level is the vibration excitation force transmitted by the train into the rails, track, and ground.

Subsection, many of the receptors currently experience vibration levels greater than the criterion of 72 VdB. Because the project alternatives would more than double the number of train passby events per day, per FRA this combined condition of exceedances above 72 VdB and doubling of events would cause vibration impacts. The predicted vibration impacts in the subsections characterized as a moderately used rail corridors would be caused primarily by HSR trains on embankment that exceed the vibration impact criterion or by shifted existing rail sources that exceed the criteria, although HSR train vibration would exceed the criterion at some locations.

In the Pacheco Pass Subsection, the alignment would largely be in a tunnel. The tunnel depth would vary depending upon the terrain elevation. Near the closest sensitive buildings, the tunnel would be more than 200 feet deep and 1,000 feet away horizontally. At these large distances and depths, ground-borne vibration would be well below the impact criteria. Similarly, at the depth and distance from the tunnel to the sensitive buildings in Pacheco Pass, ground-borne noise levels are expected to be below 25 dBA, thus below the lowest impact criteria. Under Alternatives 1 and 2, there is also a planned cut-and-cover tunnel area of the alignment where it passes under US 101 in the Morgan Hill and Gilroy Subsection. At receptors in this location, the projected ground-borne noise levels are expected to be below 25 dBA, also below the lowest impact criteria.

CEQA Conclusion

The impact under CEQA would be significant for all four project alternatives because operations would generate excessive ground-borne vibration impacts at sensitive receptors in the San Jose Diridon Station Approach and Monterey Corridor Subsections. Alternative 1 would result in 81 vibration impacts, Alternative 2 would result in 143 vibration impacts, Alternative 3 would result in 140 vibration impacts, and Alternative 4 would result in 1,203 vibration impacts. The greater number of vibration impacts under Alternative 4 are due to both HSR trains operating on blended tracks that are typically at-grade and due to increased speeds of Caltrain trains under Alternative 4. Mitigation to address this impact is identified in Section 3.4.9, CEQA Significance Conclusions. Section 3.4.7, Mitigation Measures, describes the mitigation in detail.

3.4.7 Mitigation Measures

Significant impacts under CEQA would be associated with project construction and operations activities, including noise impacts from construction activity, noise impacts from project operations, noise impacts from increased project-related vehicle traffic, exposure of buildings and sensitive receptors to vibration impacts from construction, and exposure of buildings and sensitive receptors to increased vibration levels from project operations. The Authority has developed standardized mitigation measures that would be implemented to address impacts from noise and vibration generated by project construction and operations. As described in this section, the construction noise and vibration mitigation measures will reduce impacts on sensitive receptors, but will not completely avoid impacts. The operational measures will minimize operations impacts on sensitive receptors, but will not completely avoid impacts.

NV-MM#1: Construction Noise Mitigation Measures

Prior to construction (any ground-disturbing activities), the contractor will prepare a noise-monitoring program for Authority approval. The noise-monitoring program will describe how during construction the contractor will monitor construction noise to reduce noise levels to the noise limits (an 8-hour L_{eq} of 80 dBA during the day and 70 dBA at night for residential land use, 85 dBA for both day and night for commercial land use, and 90 dBA for both day and night for industrial land use) where a noise-sensitive receptor is present and wherever feasible. The contractor will be given the flexibility to reduce noise in the most efficient and cost-effective manner. This can be done by prohibiting certain noise-generating activities during nighttime hours or providing additional noise control measures to meet required noise limits. In addition, the noise-monitoring program will describe the actions required of the contractor to meet required noise limits. These actions will include the following nighttime and daytime noise control mitigation measures, as necessary:

- Install a temporary construction site noise barrier near a noise source.
- Avoid nighttime construction in residential neighborhoods.

- Locate stationary construction equipment as far as possible from noise-sensitive sites.
- Reroute construction truck traffic along roadways that will cause the least disturbance to residents.
- During nighttime work, use smart backup alarms, which automatically adjust the alarm level based on the background noise level, or switch off back-up alarms and replace with spotters.
- Use low-noise-emission equipment.
- Implement noise-deadening measures for truck loading and operations.
- Monitor and maintain equipment to meet noise limits.
- Line or cover storage bins, conveyors, and chutes with sound-deadening material.
- Use acoustic enclosures, shields, or shrouds for equipment and facilities.
- Use high-grade engine exhaust silencers and engine-casing sound insulation.
- Prohibit aboveground jackhammering and impact pile driving during nighttime hours.
- Minimize the use of generators to power equipment.
- Limit use of public address systems.
- Grade surface irregularities on construction sites.
- Use movable noise barriers at the source of the construction activity.
- Limit or avoid certain noisy activities during nighttime hours.
- To mitigate noise related to pile driving, use an auger to install the piles instead of a pile driver to reduce noise levels substantially. If pile driving is necessary, limit the time of day that the activity can occur.

The Authority will establish and maintain in operation until completion of construction a toll-free "hotline" regarding the project construction activities. The Authority will arrange for all incoming messages to be logged (with summaries of the contents of each message) and for a designated representative of the Authority to respond to hotline messages within 24 hours (excluding weekends and holidays). The Authority will make a reasonable good-faith effort to address all concerns and answer all questions, and will include on the log its responses to all callers. The Authority will make a log of the incoming messages and the Authority's responsive actions publicly available via request on its website.

The contractor will provide the Authority with an annual report by January 31 of the following year documenting how it implemented the noise monitoring program.

This measure would have limited to no secondary environmental impacts because the temporary measures are limited to the construction zone itself and would not exacerbate any other environmental impacts of construction.

NV-MM#2: Construction Vibration Mitigation Measures

Prior to construction involving impact pile driving within 50 feet of any building, the contractor will provide the Authority with a vibration technical memorandum documenting how project pile driving criteria will be met. Upon approval of the technical memorandum by the Authority, and where a noise-sensitive receptor is present, the contractor will comply with the vibration reduction methods described in that memorandum. Potential construction vibration building damage is only anticipated from impact pile driving at very close distances to buildings. If pile driving occurs more than 50 feet from buildings, or if alternative methods such as push piling or auger piling are used, damage from construction vibration is not expected to occur. When a construction scenario has been established, the contractor will conduct pre-construction surveys at locations within 50 feet of pile driving to document the existing condition of buildings in case damage is reported during or

after construction. The contractor will arrange for the repair of damaged buildings or will pay compensation to the property owner.

NV-MM#3: Implement Proposed California High-Speed Rail Project Noise Mitigation Guidelines

Various options exist to address the potentially severe noise effects from HSR operations. The Authority has developed Noise and Vibration Mitigation Guidelines for the statewide HSR system that sets forth three categories of mitigation measures to reduce or offset severe noise impacts from HSR operations: noise barriers, sound insulation, and noise easements. The guidelines also set forth an implementation approach that considers multiple factors for determining the reasonableness of noise barriers as mitigation for severe noise impacts, including structural and seismic safety, cost, number of affected receptors, and effectiveness. Noise barrier mitigation will be designed to reduce the exterior noise level from HSR operations from severe to moderate, according to the provisions of the FRA guidance manual (FRA 2012).

The Noise and Vibration Mitigation Guidelines, included as Volume 2, Appendix 3.4-B, describe the following mitigation measures and approach:

- **Noise Barriers**—Prior to operation of the HSR, the Authority will install noise barriers where they can achieve between 5 and 15 dB of exterior noise reduction, depending on their height and location relative to the tracks. The primary requirements for an effective noise barrier are that the barrier must (1) be high enough and long enough to break the line-of-sight between the sound source and the receiver, (2) be of an impervious material with a minimum surface density of four pounds per square foot, and (3) not have any gaps or holes between the panels or at the bottom. Because many materials meet these requirements, aesthetics, durability, cost, and maintenance considerations usually determine the selection of materials for noise barriers. Depending on the situation, noise barriers can become visually intrusive. Typically, the noise barrier style is selected with input from the local jurisdiction to reduce the visual effect of barriers on adjacent lands uses (Authority 2014). For example, noise barriers could be solid or transparent, and made of various colors, materials, and surface treatments. Transparent materials will not be used in noise barriers located in Audubon Important Bird Areas or where noise barriers are being used to attenuate bird startle effects.

  Pursuant to the Noise and Vibration Mitigation Guidelines, recommended noise barriers must meet the following criteria to be considered a reasonable and feasible mitigation measure:

  – Achieve a minimum of 5 dB of noise reduction, which is then defined as a benefited receptor.
  – The minimum number of receptors should be at least 10.
  – The length should be at least 800 feet.
  – Must be cost-effective, defined as mitigation not exceeding $95,000 per benefited receptor.

  The maximum noise barrier height will be 14 feet for at-grade sections. Berm and berm/wall combinations are the preferred types of noise barriers where space and other environmental constraints permit. On aerial structures, the maximum noise barrier height will also be 14 feet, but barrier material will be limited by engineering weight restrictions for barriers on the structure. All noise barriers will be designed to be as low as possible to achieve a substantial noise reduction.

  Noise barriers on both aerial structures and at-grade structures will consist of solid, semitransparent, or transparent materials, as defined in *Aesthetic Options for Non-Station Structures* (Authority 2014). Figure 3.4-32 shows an example of a noise barrier that meets the Authority's typical requirements, pictured at the left side of the roadway. Volume 2, Appendix 3.4-B, Noise and Mitigation Guidelines, provides additional details.

MAY 2019

Figure 3.4-32 Example of a Typical Noise Barrier

- **Install Building Sound Insulation**—If noise barriers are not proposed for receptors with severe impacts, or if proposed noise barriers do not reduce exterior sound levels to below a severe impact level, the Authority will consider providing sound insulation as a potential additional mitigation measure on a case-by-case basis. Sound insulation of residences and institutional buildings to improve outdoor-to-indoor noise reduction is a mitigation measure that can be considered when the use of noise barriers is not feasible in providing a reasonable level (5 to 7 dBA) of noise reduction. Although this approach has no effect on noise in exterior areas, it may be the best choice for sites where noise barriers are not feasible or desirable and for buildings where indoor sensitivity is of most concern. Substantial improvements in building sound insulation (on the order of 5 to 10 dBA) can usually be achieved by adding an extra layer of glazing to windows, by sealing holes in exterior surfaces that act as sound leaks, and by providing forced ventilation and air conditioning so that windows do not need to be opened.
- **Noise Easements**—If a substantial noise reduction cannot be completed through installation of noise barriers or installing sound insulation, the Authority will consider acquiring a noise easement on properties with a severe impact on a case-by-case basis. An agreement between the Authority and the property owner can be established wherein the property owner releases the right to petition the Authority regarding the noise level and subsequent disruptions. This will take the form of an easement that will encompass the property boundaries to the right-of-way of the rail line. The Authority will consider this mitigation measure only in isolated cases where other mitigation is ineffective or infeasible.

Noise barriers could have secondary impacts on visual aesthetics and require tree or vegetation removal. Depending on their design, height, and location, noise barriers can become visually intrusive, blocking views or creating places for unwanted graffiti. Within the Caltrain Corridor portions of Alternative 4, noise barriers will be installed within the fenced areas of the existing Caltrain right-of-way, which is often shielded from view by fencing or landscaping (described in Section 3.16, Aesthetics and Visual Quality). Per Mitigation Measure AVQ-MM#7 (see description in Section 3.16, Aesthetics and Visual Quality), as part of the final design and construction management plan, the Authority will work with local jurisdictions to develop the appropriate noise barrier style and treatments for visually sensitive areas, to reduce the visual effect of barriers on adjacent land uses. For example, noise barriers could be solid or transparent, made of various

colors, materials, and surface treatments, screened with vegetation, or treated with surface coatings to facilitate cleaning and removal of graffiti. Providing sound insulation will involve modest building retrofit activity similar to routine residential or commercial window modifications or insulation replacement and would not result in significant secondary effects.

NV-MM#4: Support Potential Implementation of Quiet Zones by Local Jurisdictions

Trains sound warning horns when approaching at-grade crossings because it is required by the FRA as a safety precaution (49 C.F.R. Parts 222 and 229). FRA does allow for the possibility of establishing horn-free Quiet Zones, which will eliminate the requirement for all trains to routinely sound their warning horns when approaching at-grade highway/rail crossings. Establishing Quiet Zones can only be legally undertaken by local jurisdictions; HSR cannot legally establish or require a Quiet Zone. However, HSR will assist local communities with this process through the installation of four-quad gates and channelization at all at-grade crossings that presently lack them, which will help cities to implement Quiet Zones, should they choose to do so. The Authority will assist with the preparation of technical analysis and provide input for the Quiet Zone application, which the local communities could then use as part of their application to FRA. Establishing Quiet Zones will eliminate train warning horns for all trains approaching at-grade highway and rail crossings under normal, nonemergency situations.

NV-MM#5: Vehicle Noise Specification

During HSR vehicle technology procurement, the Authority will require bidders to meet the federal regulations (40 C.F.R. §§201.12/201.13) at the time of procurement for locomotives (currently a 90-dB-level standard) operating at speeds faster than 45 mph. This measure would have no secondary environmental impacts.

NV-MM#6: Special Trackwork at Crossovers, Turnouts, and Insulated Joints

Prior to construction, the contractor will provide the Authority with an HSR operations noise technical report for review and approval. The report will address minimization or elimination of rail gaps at crossovers and turnouts. Because the impacts of HSR wheels over rail gaps at turnouts increases HSR noise by approximately 6 dB over typical operations, turnouts can be a major source of noise impact. If the turnouts cannot be moved from sensitive areas, the noise technical report will recommend the use of special types of trackwork that eliminate the gap. The Authority will require the project design to follow the recommendations in the approved noise impact report.

Special trackwork will occur in the construction footprint and will not require additional right-of-way. Special trackwork will require additional construction equipment activity using equipment similar to that used to build the project and will result in similar temporary aesthetic, air quality, and noise impacts during the construction period.

NV-MM#7: Additional Noise Analysis during Final Design

Prior to construction, the contactor will provide the Authority with an HSR operations noise technical report for review and approval. If final design or final vehicle specifications result in changes to the assumptions underlying the noise technical report, the Authority will prepare necessary environmental documentation, as required by CEQA and NEPA, to reassess noise impacts and mitigation.

It is premature to assess the specific potential secondary impacts of final design measures. Measures adopted as a result of additional noise analysis are likely to be similar to the other noise measures identified. Thus, they would likely result in similar secondary environmental impacts during their construction that may be significant.

NV-MM#8: Project Vibration Mitigation Measures

Mitigation for operations vibration impacts can take place at the source, at the sensitive receptor, or along the propagation path from the source to the sensitive receptor. Table 3.4-22 lists the mitigation procedures and their locations.

Table 3.4-22 Vibration Mitigation Procedures and Descriptions

Mitigation Procedure	Location of Mitigation	Description
Location and design of special trackwork	Source	Review crossover, turnout, and insulated joint locations during the preliminary engineering stage. When feasible, relocate special trackwork to a less vibration-sensitive area. Install spring frogs and other non-gap trackwork to eliminate gaps and help reduce vibration levels.
Vehicle suspension	Source	Employ rail vehicle with low unsprung weight, soft primary suspension, minimum metal-on-metal contact between moving parts of the truck, and smooth wheels that are perfectly round.
Special track support systems	Source	Use floating slabs, resiliently supported ties, high-resilience fasteners, and ballast mats to help reduce vibration levels from track support system.
Building modifications	Receptor	For existing buildings, if vibration-sensitive equipment is affected by train vibration, stiffen the floor upon which the vibration-sensitive equipment is located, isolate it from the remainder of the building, or both. For new buildings, support and effectively isolate the building foundation with vibration-isolating components such as springs and elastomer pads.
Buffer zones	Receptor	Negotiate a vibration easement from the affected property owners or expand rail right-of-way.

It is premature to assess the specific potential secondary impacts of vibration measures. Special trackwork, building modifications, or other approaches adopted pursuant to this measure are likely to be similar to the other vibration-reducing measures identified. Thus, they would likely result in similar secondary environmental impacts during their construction that may be significant.

3.4.7.1 Noise Mitigation Analysis

The Authority has provided guidance regarding the implementation of noise barrier mitigation measures in Volume 2, Appendix 3.4-B. Analysts used this guidance to conduct a noise mitigation analysis to evaluate the use of noise barriers as specified in NV-MM#3 and the potential effectiveness of horn-free quiet zones that may be adopted by local jurisdictions in combination with noise barrier mitigation.

HSR train horns are not a direct source of noise impacts in the RSA under Alternatives 1, 2, and 3, but horn noise from other non-HSR trains is significant. Therefore, if use of the existing train horns could be reduced, noise levels in the project area would decrease, which would partially offset the noise increases from introducing HSR trains. Establishing Quiet Zones, which will eliminate the requirement for non-HSR trains in the RSA to routinely sound their warning horns when approaching at-grade highway/rail crossings, is a measure that will need to be undertaken by local communities, not by the Authority. Therefore, this document includes additional analysis that investigates the potential benefit provided to noise-sensitive receptors from eliminating all train horn noise in the RSA under Alternatives 1, 2, and 3. Section 3.4.9, CEQA Significance Conclusions, provides this information.

Alternative 4 would cause HSR horn noise throughout the shared Caltrain corridor from San Jose to Gilroy. Therefore, an analysis of the potential benefit that could be provided by instituting Quiet Zones is provided under Alternative 4. Section 3.4.9, CEQA Significance Conclusions, provides more information.

Noise Barriers

NV-MM#3 identifies noise barriers in the form of noise barriers as a potential mitigation measure to avoid severe noise impacts from project operations. Analysts assessed the feasibility and cost-

effectiveness of using noise barriers to mitigate severe impacts from project operations based on the criteria listed in Volume 2, Appendix 3.4-B.

The Authority would examine alternatives to avoid, minimize, or mitigate severe noise impacts. If severe noise impacts cannot be avoided, then the Authority will take steps to reduce severe noise substantially through mitigation measures that are reasonable, physically feasible, practical, and cost-effective. The minimum number of receptors should be at least 10, and the length of a noise barrier should be at least 800 feet. Barrier heights up to a maximum of 14 feet for at-grade and aerial structure sections would be considered. Mitigation options for areas that require barriers over 14 feet would be studied on a case-by-case basis. The community should approve of implementation of the recommended noise barriers (75 percent of all affected parties). The cost for constructing a noise barrier along the at-grade portion of the alignment is estimated to be $70 per square foot, and the cost to build a noise barrier along the elevated portion of the alignment is estimated to be $65 per square foot. The total cost of mitigation cannot exceed $95,000 per benefitted receptor. This cost is determined by dividing the total cost of the mitigation measure by the number of noise-sensitive buildings that receive a substantial (i.e., 5 dBA or greater) outdoor noise reduction. This calculation generally limits the use of mitigation in areas that have few or isolated residential buildings. If the density of residential dwellings is insufficient to make the measure cost-effective, then other noise abatement measures, such as sound insulation [or a local noise barrier], will be considered on a case-by-case basis. If sound insulation is identified as an alternative mitigation measure, the treatment must provide a substantial increase in noise reduction (i.e., 5 dBA or greater) between the outside and inside noise levels for interior habitable rooms. Receptors that receive at least a 5 dBA noise reduction from a noise barrier are described as benefitted receptors.

Table 3.4-23 shows the proposed noise barriers found to be cost-effective for Alternative 1. The table includes the approximate start and end locations of the barriers, the length, height, and side of track. The table also shows the number of severe and moderate noise impacts that would be benefitted with each barrier,[15] as well as the number of residual noise impacts that would remain, even though they would be behind the proposed noise barriers.

Analysts found six potential noise barriers to be cost-effective for Alternative 1. The proposed noise barriers would mitigate 107 severe impacts and 551 moderate impacts. The first two proposed noise barriers would be in the San Jose Diridon Station Approach Subsection and the next three would be in the Monterey Corridor Subsection, where the track profile is on embankment. The proposed barrier heights would range from 5 to 14 feet above the top of the rail. Three proposed noise barriers would be the same for all project alternatives. The sixth potential noise barrier for Alternative 1 would be in the Morgan Hill and Gilroy Subsection and would continue for 6,800 feet at a height of 14 feet above the top of the rail.

Table 3.4-24 shows the proposed noise barriers that were found to be cost-effective for Alternative 2. Analysts found 11 potential noise barriers to be cost-effective. The proposed noise barriers would mitigate 564 severe impacts and 1,065 moderate impacts. The first four proposed noise barriers would be in the Monterey Corridor Subsection. Barriers 1, 2, and 3 would be the same as those proposed for Alternatives 1 and 3. Barrier 4 would be in both the Monterey Corridor Subsection and the Morgan Hill and Gilroy Subsection, and the proposed height would be 14 feet above the top of the rail. Barriers 5 through 11 would be in the Morgan Hill and Gilroy Subsection and the proposed heights would range from 5 to 14 feet above the top of the rail.

[15] Based on public comments, additional noise analysis was conducted at the overnight parking areas within Los Banos and Volta Wildlife Areas, which are sometimes used by individuals to sleep in their vehicles. The analyses determined that noise impacts on these individuals would be severe. However, these two additional severe noise impacts in the San Joaquin Valley Subsection on individuals sleeping at the Volta and Los Banos overnight parking areas would be mitigated through the implementation of mitigation measure BIO-MM#80: Minimize Permanent Intermittent Noise, Visual, and Train Strike Impacts on Wildlife Movement. These noise/visual barriers, designed to address the impact of noise on avian and mammalian wildlife, will also reduce noise at the overnight parking areas. With BIO-MM#80, there will be no noise impact at the Los Banos overnight parking area and moderate impact at the Volta overnight parking area.

Table 3.4-25 shows the proposed noise barriers found to be cost-effective for Alternative 3. Analysts found three potential noise barriers to be cost-effective. The proposed noise barriers for Alternative 3 would mitigate 51 severe impacts and 140 moderate impacts. The three proposed noise barriers would be in the Monterey Corridor Subsection and would be the same as those proposed for Alternatives 1 and 2.

Table 3.4-26 shows the proposed noise barriers that were found to be cost-effective for Alternative 4. Analysts found 33 potential noise barriers to be cost-effective. The proposed noise barriers for Alternative 4 would mitigate 913 severe impacts and 440 moderate impacts. The first five proposed noise barriers would be in the San Jose Diridon Station Approach Subsection and the next nine would be in the Monterey Corridor Subsection; the proposed heights would range from 8 to 14 feet above the top of the rail. Barrier 15 would be in both the Monterey Corridor Subsection and the Morgan Hill and Gilroy Subsection, and the proposed height would be 8 feet above the top of the rail. Barriers 16 through 33 would be in the Morgan Hill and Gilroy Subsection. The proposed barrier heights would range from 10 to 14 feet above the top of the rail.

Table 3.4-23 Proposed Noise Barriers—Alternative 1

Barrier	City	Start Stationing	End Stationing	Length (feet)	Height (feet)	Noise Barrier Coverage (square feet)	Side of Track	Number of Severe Impacts Benefited	Number of Moderate Impacts Benefited	Number of Residual Impacts (Severe/ Moderate)
1	Santa Clara	2261+00	2302+00	4,100	8	32,800	West	13	98	0 / 0
2	Santa Clara & San Jose	2351+00	2361+00	1,000	9	9,000	West	4	7	0 / 0
3	San Jose	208+00	237+00	2,900	14	40,600	East	25	58	0 / 0
4	San Jose	208+00	236+00	2,800	5	14,000	West	23	56	0 / 0
5	San Jose	239+00	270+00	3,100	8	24,800	East	2	26	0 / 0
6	San Jose	1581+00	1649+00	6,800	14	95,200	West	40	306	0 / 28
Total[1]								**107**	**551**	**0 / 28**

[1] Based on public comments, additional noise analysis was conducted at the overnight parking areas within Los Banos and Volta Wildlife Areas, which are sometimes used by individuals to sleep in their vehicles. The analyses determined that noise impacts on these individuals would be severe. However, these two additional severe noise impacts in the San Joaquin Valley Subsection at the Volta and Los Banos overnight parking areas would be mitigated through the implementation of mitigation measure BIO-MM#80: Minimize Permanent Intermittent Noise, Visual, and Train Strike Impacts on Wildlife Movement. With BIO-MM#80, there will be no noise impact at the Los Banos overnight parking area and moderate impact at the Volta overnight parking area. These results are the same for all four alternatives because they are the same at both locations.

Table 3.4-24 Proposed Noise Barriers—Alternative 2

Barrier	City	Start Stationing	End Stationing	Length (feet)	Height (feet)	Noise Barrier Coverage (square feet)	Side of Track	Number of Severe Impacts Benefited	Number of Moderate Impacts Benefited	Number of Residual Impacts (Severe/ Moderate)
1	San Jose	208+00	237+00	2,900	14	40,600	East	26	58	0 / 0
2	San Jose	208+00	236+00	2,800	5	14,000	West	23	56	0 / 0
3	San Jose	239+00	270+00	3,100	8	24,800	East	2	26	0 / 0
4	San Jose	567+00	715+00	5,900	14	82,600	East	48	98	0 / 0
5	Morgan Hill	1071+00	1214+00	14,300	14	200,200	West	217	178	0 / 24
6	Morgan Hill	1072+00	1107+00	3,500	12	42,000	East	16	28	0 / 0
7	Morgan Hill	1158+00	1236+00	7,800	14	109,200	East	71	165	0 / 2
8	Morgan Hill	1289+00	1301+00	1,200	10	12,000	West	100	100	0 / 100
9	Gilroy	1581+00	1649+00	6,800	14	95,200	West	20	326	0 / 0
10	Gilroy	1656+00	1675+00	1,900	5	9,500	East	21	20	0 / 0
11	Gilroy	1705+00	1724+00	1,900	14	26,600	East	20	10	0 / 7
Total								**564**	**1,065**	**0 / 133**

Table 3.4-25 Proposed Noise Barriers—Alternative 3

Barrier	City	Start Stationing	End Stationing	Length (feet)	Height (feet)	Noise Barrier Coverage (square feet)	Side of Track	Number of Severe Impacts Benefited	Number of Moderate Impacts Benefited	Number of Residual Impacts (Severe/ Moderate)
1	San Jose	208+00	237+00	2,900	14	40,600	East	26	58	0 / 0
2	San Jose	208+00	236+00	2,800	5	14,000	West	23	56	0 / 0
3	San Jose	239+00	270+00	3,100	8	24,800	East	2	26	0 / 0
Total								**51**	**140**	**0 / 0**

Table 3.4-26 Proposed Noise Barriers without Quiet Zones—Alternative 4

Barrier	City	Start Stationing	End Stationing	Length (feet)	Height (feet)	Noise Barrier Coverage (square feet)	Side of Track	Number of Severe Impacts Benefited	Number of Moderate Impacts Benefited	Number of Residual Impacts (Severe/ Moderate)
1	Santa Clara & San Jose	2963+00	2973+00	1,000	9	9,000	West	3	1	0 / 0
2	San Jose	3105+00	3114+00	900	12	10,800	West	23	0	0 / 0
3	San Jose	3114+00	3120+00	600	10	6,000	West	11	1	0 / 0
4	San Jose	3120+00	3137+00	1,700	12	20,400	West	41	0	0 / 0
5	San Jose	3123+00	3138+00	1,500	12	18,000	East	20	0	0 / 0
6	San Jose	3246+00	3275+00	2,900	14	40,600	East	23	61	0 / 0
7	San Jose	3278+00	3309+00	3,100	8	24,800	East	23	4	0 / 0
8	San Jose	385+00	401+00	1,600	12	19,200	West	26	3	0 / 0
9	San Jose	403+00	428+00	2,500	12	30,000	West	79	0	0 / 0
10	San Jose	403+00	428+00	2,500	14	35,000	East	19	34	0 / 13
11	San Jose	430+00	458+00	2,800	12	33,600	West	17	4	0 / 0
12	San Jose	430+00	444+00	1,400	12	16,800	East	17	0	0 / 0
13	San Jose	458+00	472+00	1,400	12	16,800	West	33	0	0 / 0
14	San Jose	474+00	487+00	1,300	12	15,600	West	32	0	0 / 0
15	San Jose	644+00	677+00	3,300	8	26,400	West	49	11	0 / 0
16	Morgan Hill	1024+00	1053+00	2,900	10	29,000	West	36	47	0 / 0
17	Morgan Hill	1110+00	1132+00	2,200	10	22,000	West	22	0	0 / 0
18	Morgan Hill	1133+00	1144+00	1,100	10	11,000	West	30	1	0 / 0
19	Morgan Hill	1133+00	1157+00	2,400	12	28,800	East	63	62	0 / 0
20	Morgan Hill	1145+00	1157+00	1,200	10	12,000	West	8	10	0 / 0

Barrier	City	Start Stationing	End Stationing	Length (feet)	Height (feet)	Noise Barrier Coverage (square feet)	Side of Track	Number of Severe Impacts Benefited	Number of Moderate Impacts Benefited	Number of Residual Impacts (Severe/ Moderate)
21	Morgan Hill	1159+00	1165+00	600	10	6,000	West	30	2	0 / 0
22	Morgan Hill	1159+00	1175+00	1,600	10	16,000	East	29	38	0 / 0
23	Morgan Hill	1175+00	1185+00	1,000	14	14,000	East	14	0	0 / 2
24	Morgan Hill	1239+00	1251+00	1,200	10	12,000	West	100	100	0 / 0
25	Morgan Hill	1278+00	1290+00	1,200	10	12,000	West	14	6	0 / 0
26	Gilroy	1606+00	1618+00	1,200	10	12,000	West	37	9	0 / 0
27	Gilroy	1606+00	1627+00	2,100	10	21,000	East	42	0	0 / 1
28	Gilroy	1632+00	1643+00	1,100	10	11,000	West	2	29	0 / 0
29	Gilroy	1632+00	1643+00	1,100	12	13,200	East	21	0	0 / 0
30	Gilroy	1643+50	1654+00	1,050	10	10,500	West	2	0	0 / 0
31	Gilroy	1643+50	1654+00	1,050	14	14,700	East	23	7	0 / 0
32	Gilroy	1661+00	1668+00	700	12	8,400	West	14	0	0 / 0
33	Gilroy	1668+00	1679+00	1,100	12	13,200	West	10	10	0 / 0
Total								**913**	**440**	**0 / 16**

Figure 3.4-33 through Figure 3.4-35 illustrate the approximate locations of the potential noise barriers for Alternative 1. The approximate locations of the potential noise barriers for Alternative 2 are illustrated on Figure 3.4-36 and Figure 3.4-37. The approximate locations of the potential noise barriers for Alternative 3 are illustrated on Figure 3.4-38. The approximate locations of the potential noise barriers for Alternative 4 are illustrated on Figure 3.4-39 through Figure 3.4-41. Figure 3.4-33 through Figure 3.4-41 also show the residual noise-affected receptors that would remain with the potential noise barriers. More detailed maps illustrating the potential noise barriers and residual noise-affected receptors for each alternative are included in Volume 2, Appendix 3.4-C.

Horn Noise

NV-MM#4 identifies Quiet Zones as a method to reduce horn noise in the corridor. Many of the projected noise impacts under Alternative 4 would be from train warning horn noise in the RSA. Caltrain, freight, and HSR trains would sound warning horns as they approach at-grade roadway crossings and passenger stations under Alternative 4. Trains are presumed to sound horns while approaching Caltrain stations following Caltrain operating policy. Trains sound the warning horns approaching at-grade crossings because it is required by FRA as a safety precaution. FRA does allow for the possibility of establishing Quiet Zones, which would eliminate the requirement for all trains to routinely sound their warning horns when approaching at-grade highway/rail crossings. Establishing Quiet Zones is a measure that will need to be undertaken by local communities. The project includes the installation of four-quad gates at all at-grade crossings currently without them, which would help cities to implement Quiet Zones, should they choose to do so.

A noise analysis conducted for Alternative 4 examined the use of Quiet Zones in the RSA in conjunction with noise barriers. Analysts evaluated the benefit of eliminating train horn noise for all trains approaching at-grade crossings and then additionally analyzed potential noise barriers. This analysis assumed that all trains would continue to sound warning horns approaching passenger stations, consistent with Caltrain operating policy.

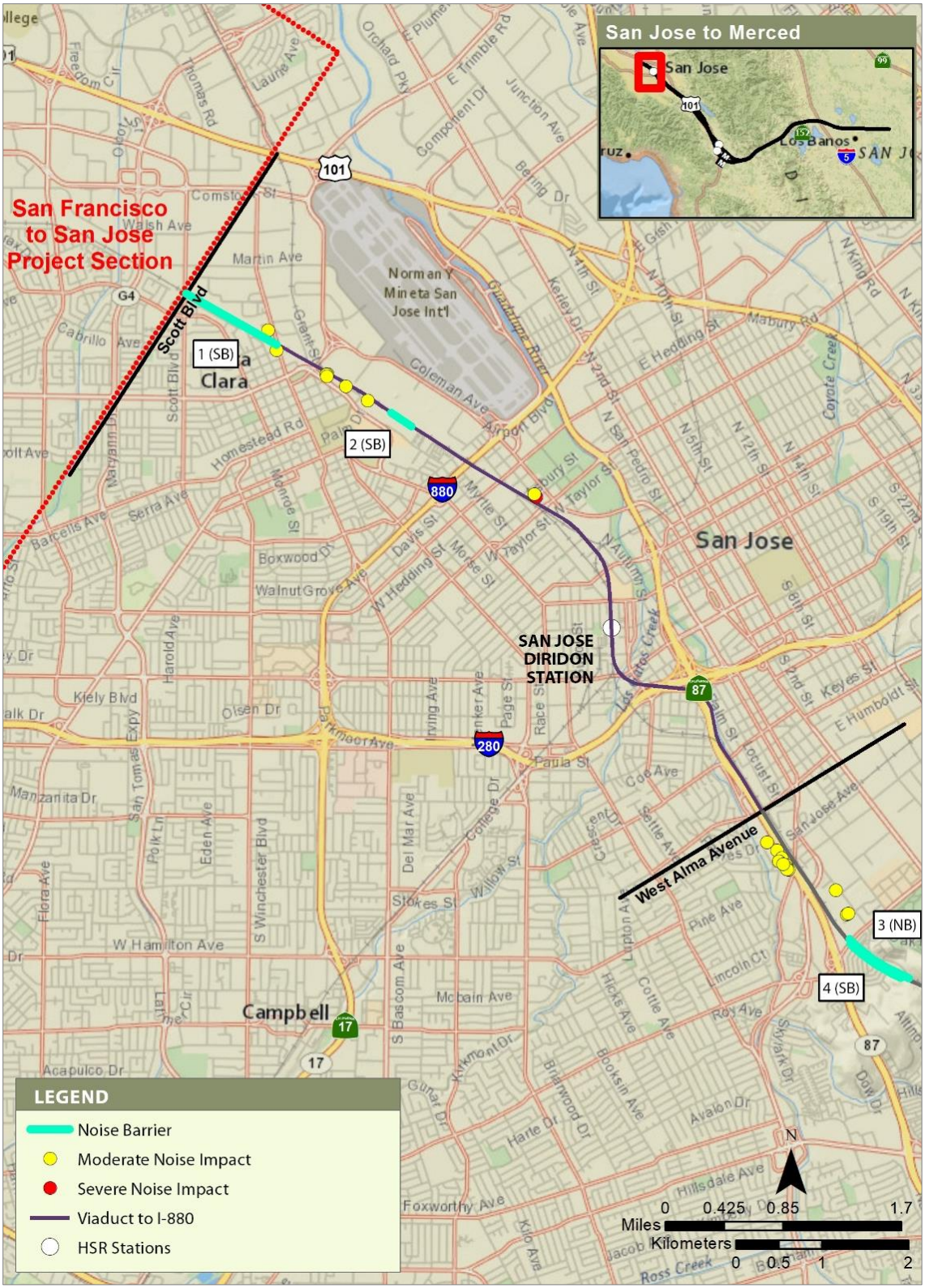
Table 3.4-27 shows the proposed noise barriers with Quiet Zones that were found to be cost-effective for Alternative 4. With Quiet Zones, analysts found eight potential noise barriers to be cost-effective for Alternative 4. With Quiet Zones in place, the proposed noise barriers would mitigate an additional 250 severe impacts and 187 moderate impacts. The first proposed noise barrier would be in the San Jose Diridon Station Approach Subsection and the next two would be located in the Monterey Corridor Subsection. Barrier 4 would be in both the Monterey Corridor Subsection and the Morgan Hill and Gilroy Subsection. The remaining four proposed noise barriers would be in the Morgan Hill and Gilroy Subsection.

Figure 3.4-42 through Figure 3.4-44 illustrate the approximate locations of the potential noise barriers with Quiet Zones under Alternative 4. These figures also illustrate the residual noise-affected receptors that would remain with the Quiet Zones and potential noise barriers. More detailed maps illustrating the potential noise barriers with Quiet Zones and residual noise-affected receptors under Alternative 4 are included in Volume 2, Appendix 3.4-C.

Alternatives 1, 2, and 3 would not have HSR train horn noise; however, they would have horn noise from Caltrain, other passenger trains, and freight trains. Analysts evaluated additional noise mitigation to determine if eliminating the use of train warning horns along the project alignment would provide a benefit. Section 3.4.4.3, Methods for Impact Analysis, discusses the use of train warning horns in the RSA. Under Alternatives, 1, 2, and 3, much of the project would be in existing rail corridors with Caltrain, freight, and other passenger trains operating on separate tracks parallel to the HSR tracks.

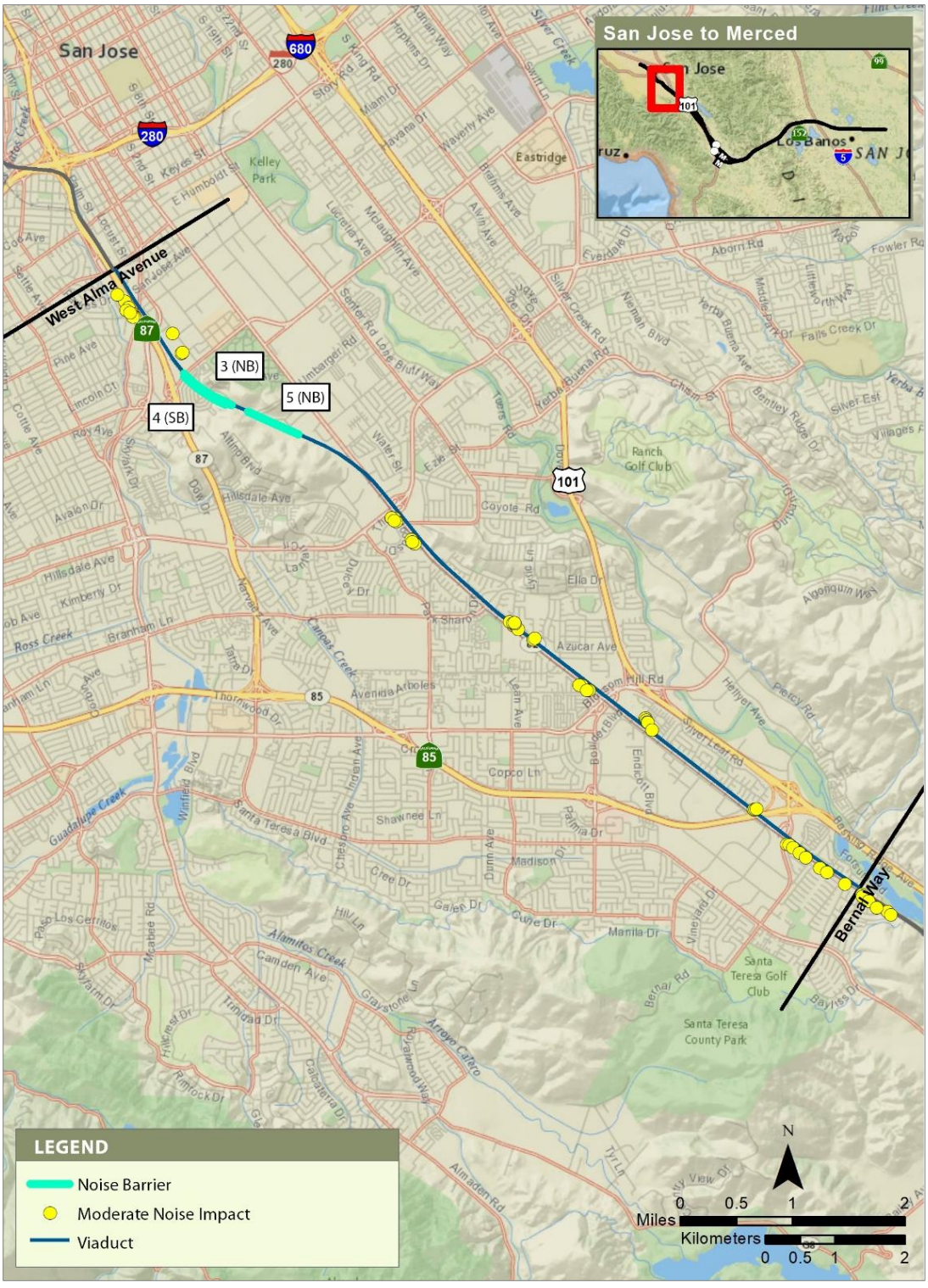
As discussed in Section 3.4.4.3, analysts based the impact assessment on a comparison of the existing noise exposure to the future total noise exposure with the project alternatives. Therefore, even though non-HSR trains would sound warning horns at grade crossings and passenger stations with or without the HSR alternatives, reducing future total noise levels by eliminating horn sounding could reduce the number of project noise impacts under Alternatives 1, 2, and 3.

The horn noise mitigation analysis for Alternatives 1, 2, and 3 calculated the future noise levels without any train horns in the RSA. Eliminating horn noise as a potential mitigation measure was analyzed in conjunction with the noise barrier analysis.



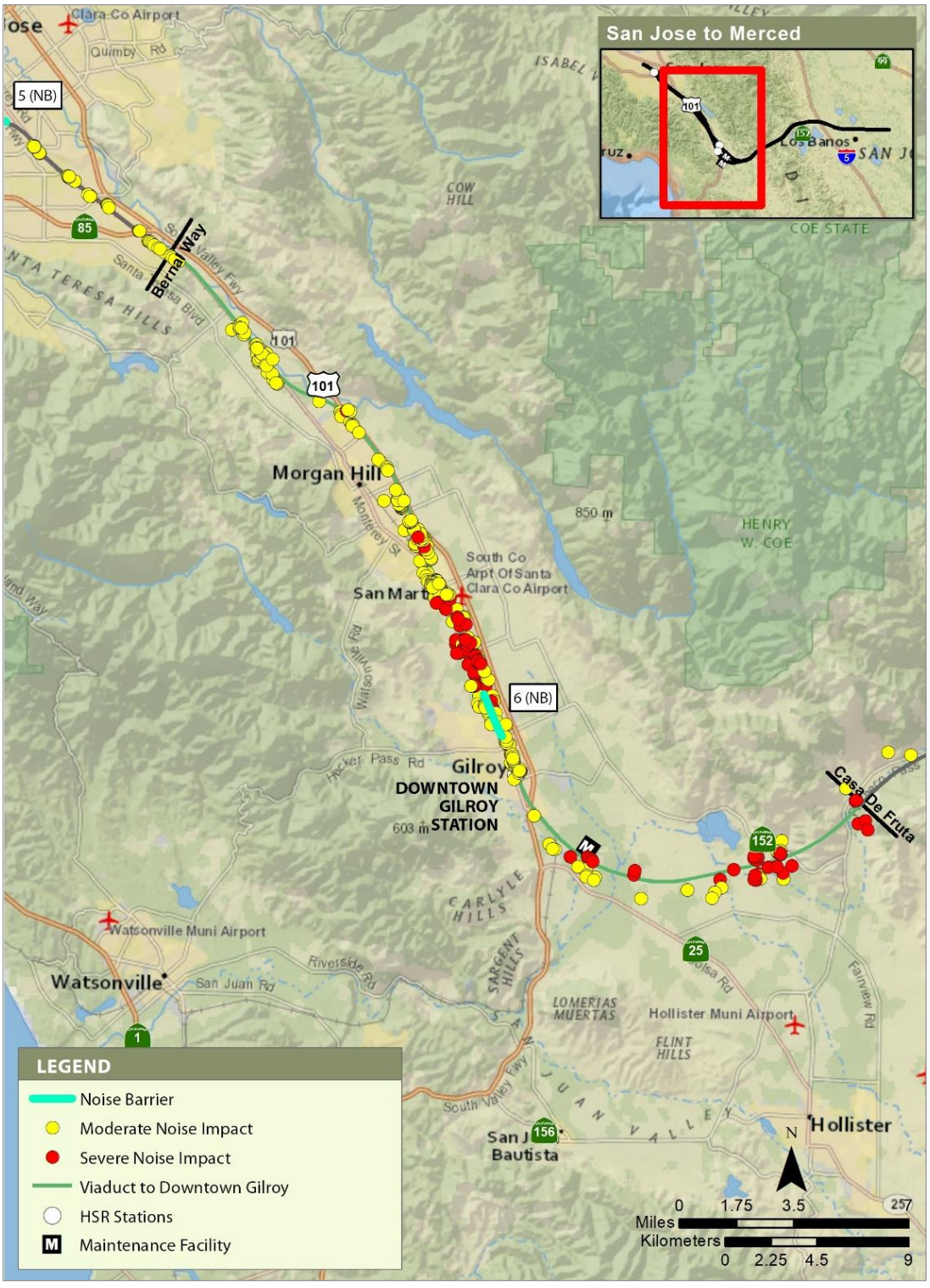
SEPTEMBER 2020

Figure 3.4-33 Proposed Noise Barriers and Residual Noise Impacts—Alternative 1 (San Jose Diridon Station Approach Subsection)



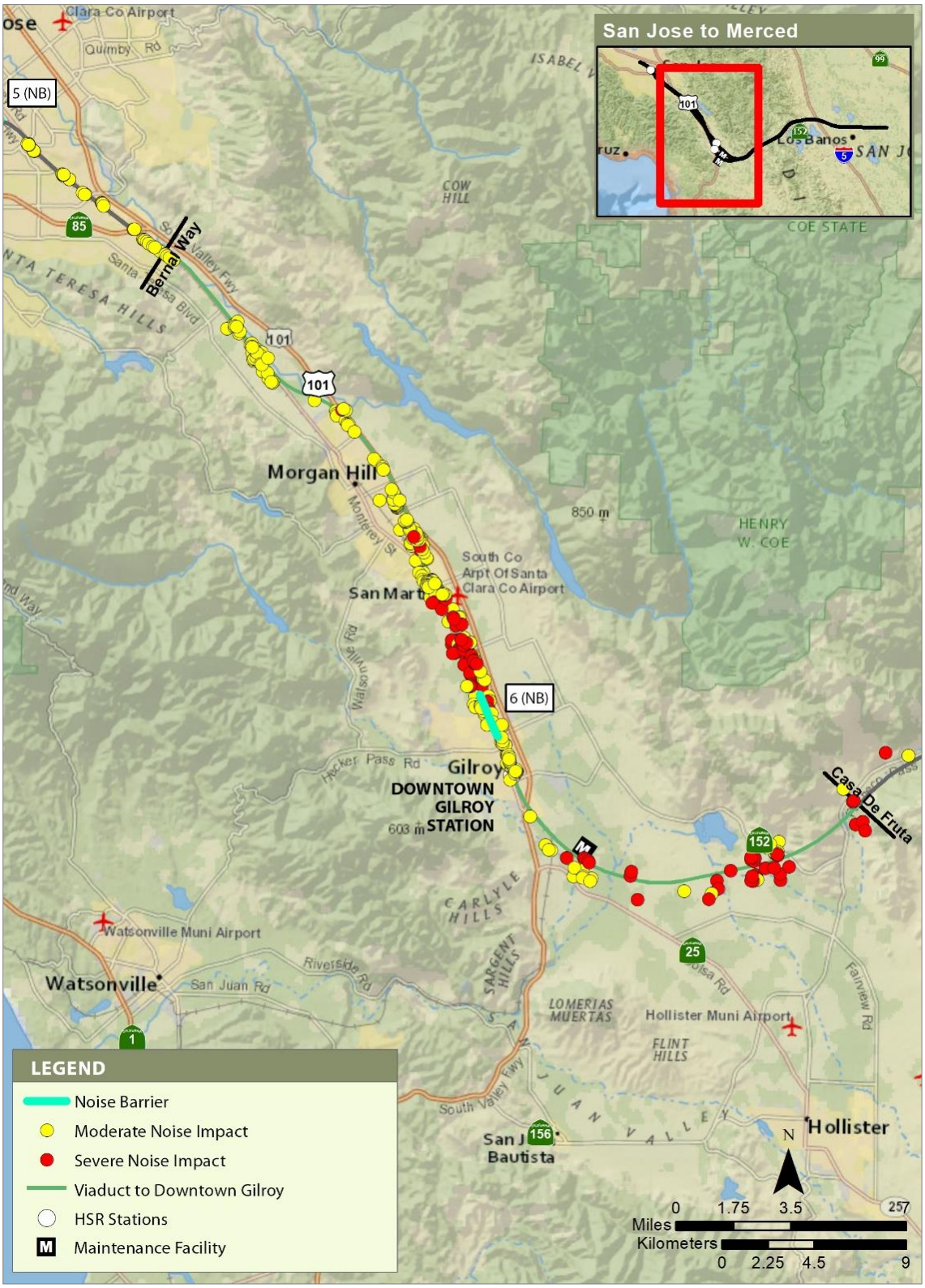
SEPTEMBER 2020

Figure 3.4-34 Proposed Noise Barriers and Residual Noise Impacts—Alternative 1 (Monterey Corridor Subsection)



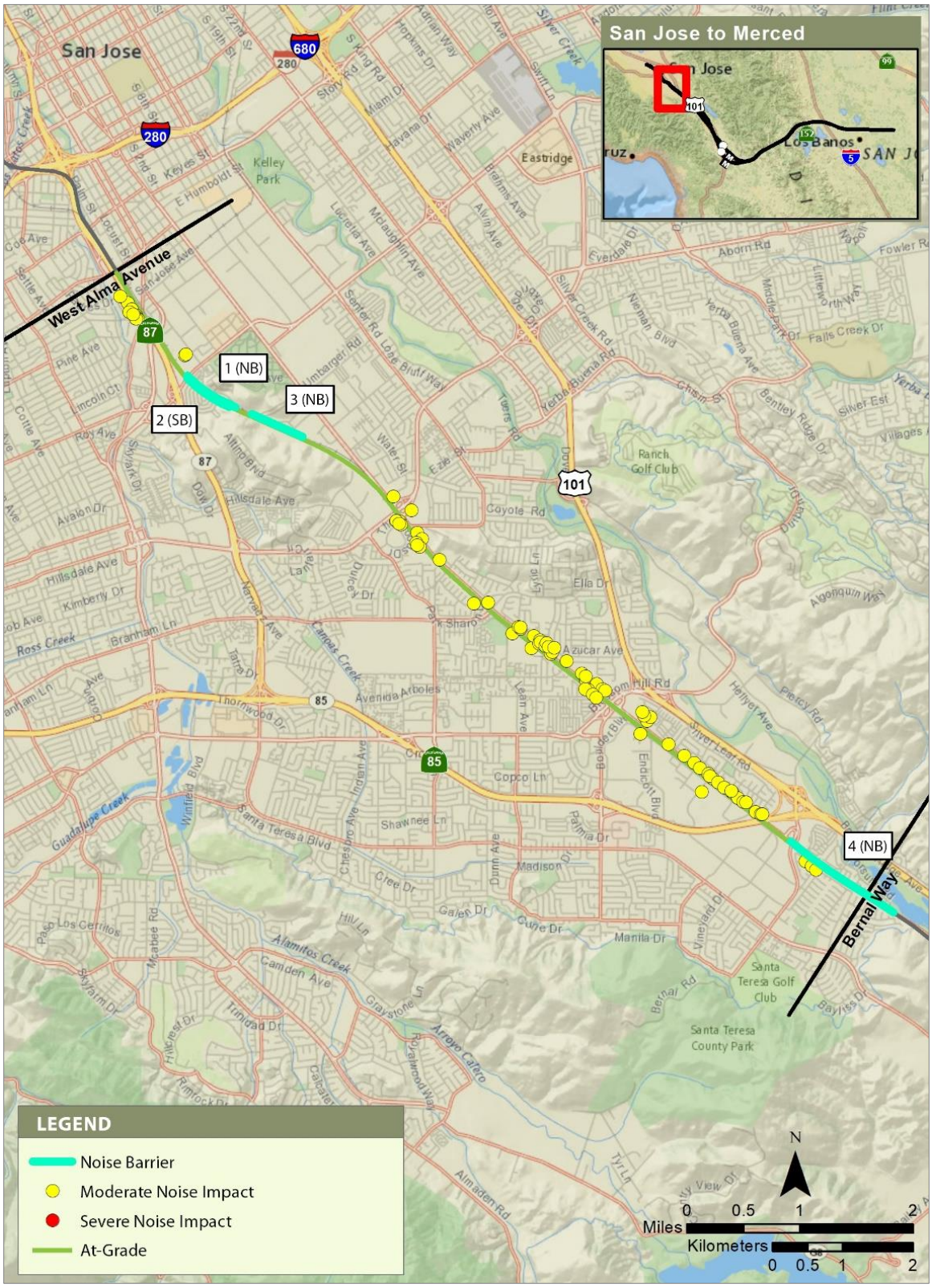
SEPTEMBER 2020

Figure 3.4-35a Proposed Noise Barriers and Residual Noise Impacts—Alternative 1 without the Tunnel Design Variant (Morgan Hill and Gilroy Subsection)



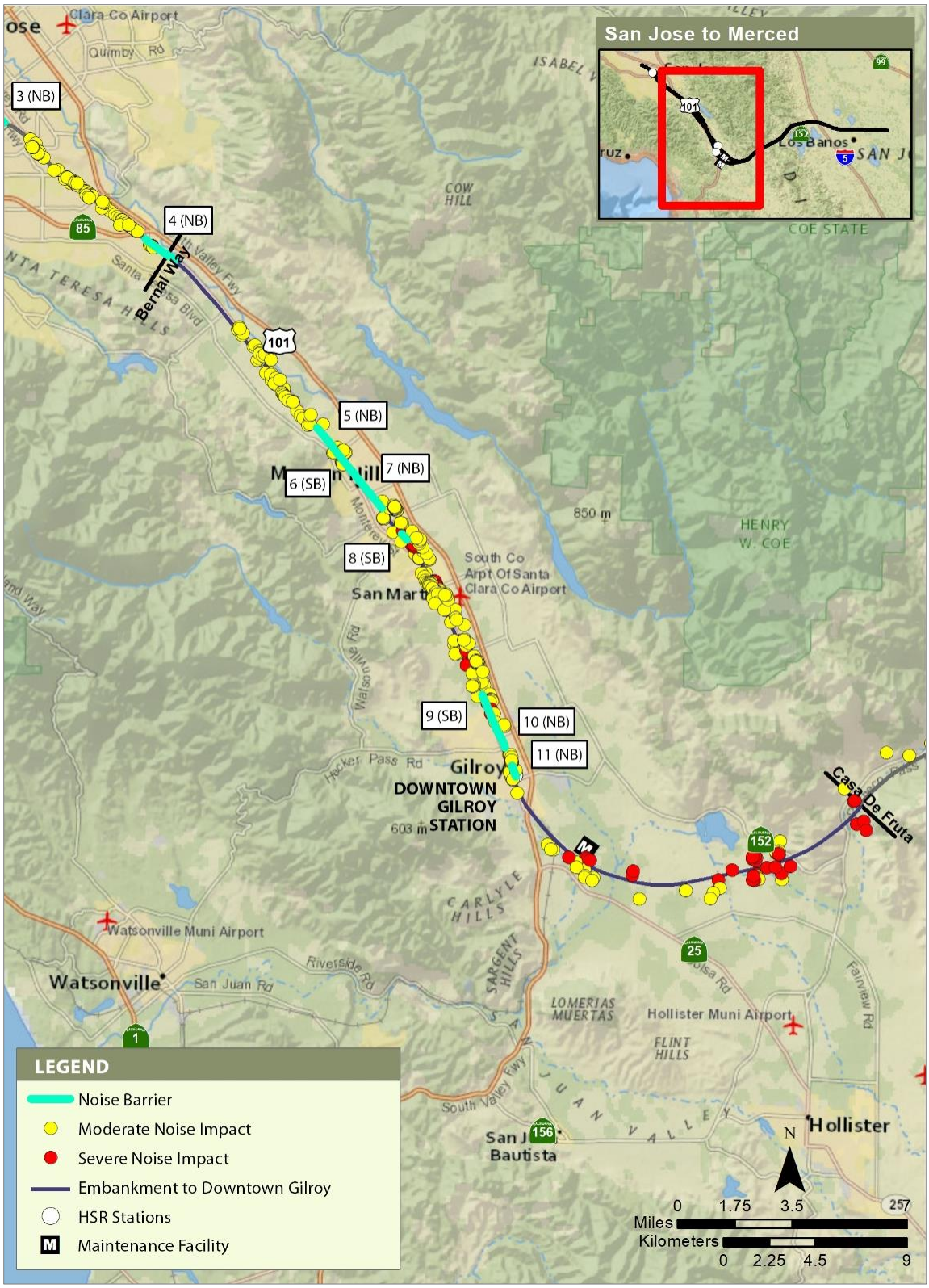
SEPTEMBER 2020

Figure 3.4-35b Proposed Noise Barriers and Residual Noise Impacts—Alternative 1 with the Tunnel Design Variant (Morgan Hill and Gilroy Subsection)



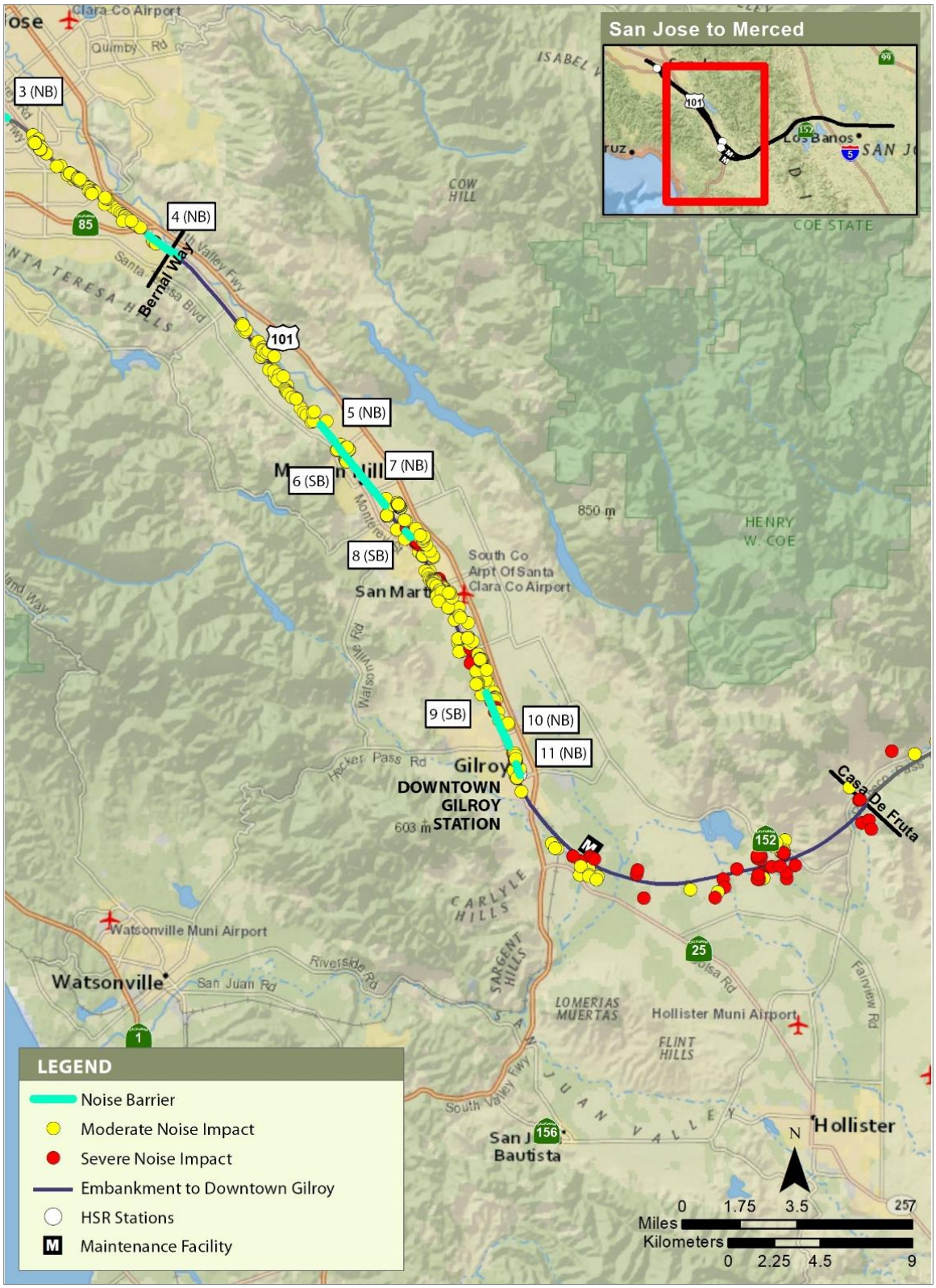
SEPTEMBER 2020

Figure 3.4-36 Proposed Noise Barriers and Residual Noise Impacts—Alternative 2 (Monterey Corridor Subsection)



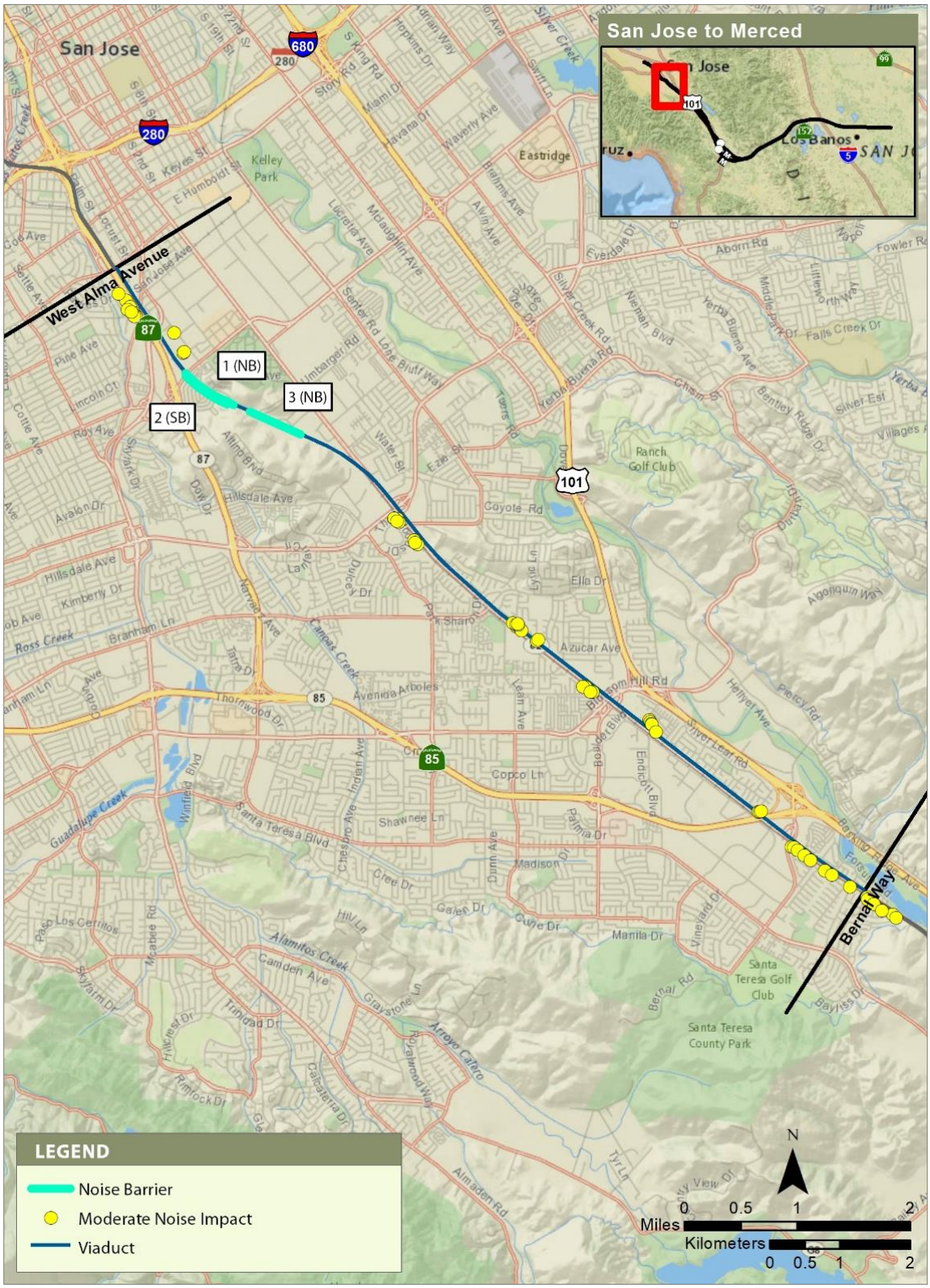
SEPTEMBER 2020

Figure 3.4-37a Proposed Noise Barriers and Residual Noise Impacts—Alternative 2 without the Tunnel Design Variant (Morgan Hill and Gilroy Subsection)



SEPTEMBER 2020

Figure 3.4-37b Proposed Noise Barriers and Residual Noise Impacts—Alternative 2 with the Tunnel Design Variant (Morgan Hill and Gilroy Subsection)

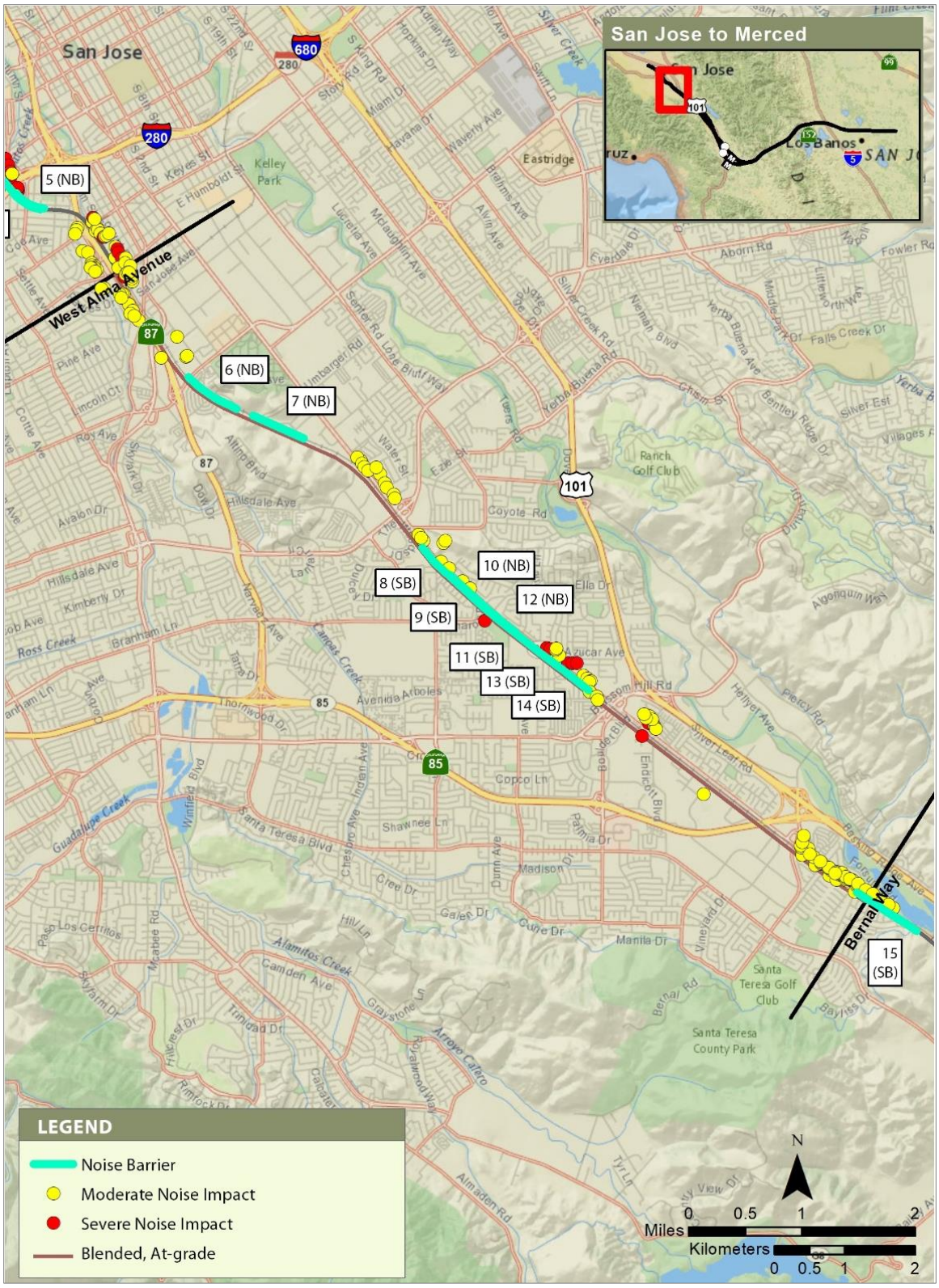


SEPTEMBER 2020

Figure 3.4-38 Proposed Noise Barriers and Residual Noise Impacts—Alternative 3 (Monterey Corridor Subsection)

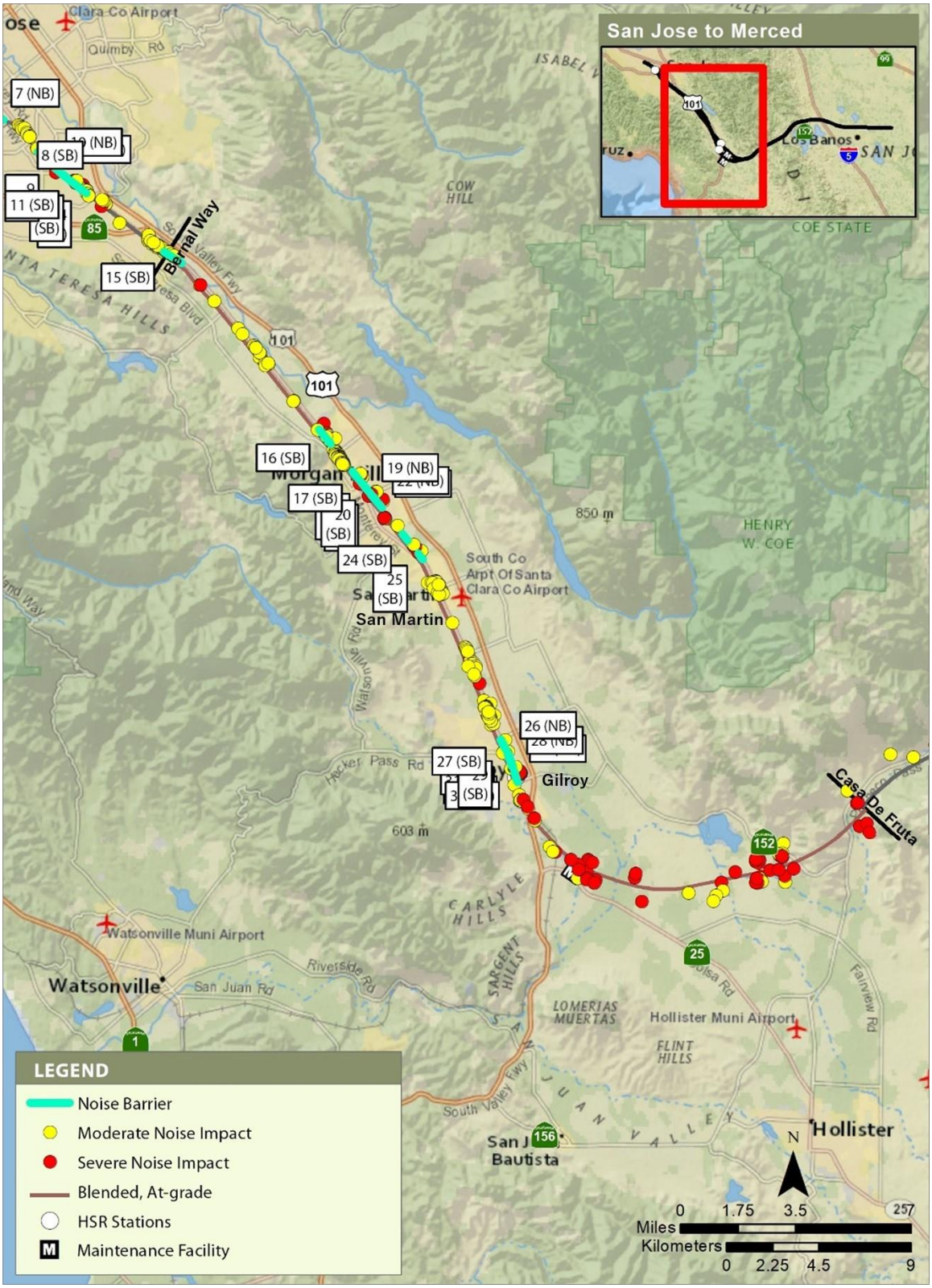
SEPTEMBER 2020

Figure 3.4-39 Proposed Noise Barriers and Residual Noise Impacts—Alternative 4 (San Jose Diridon Station Approach Subsection)



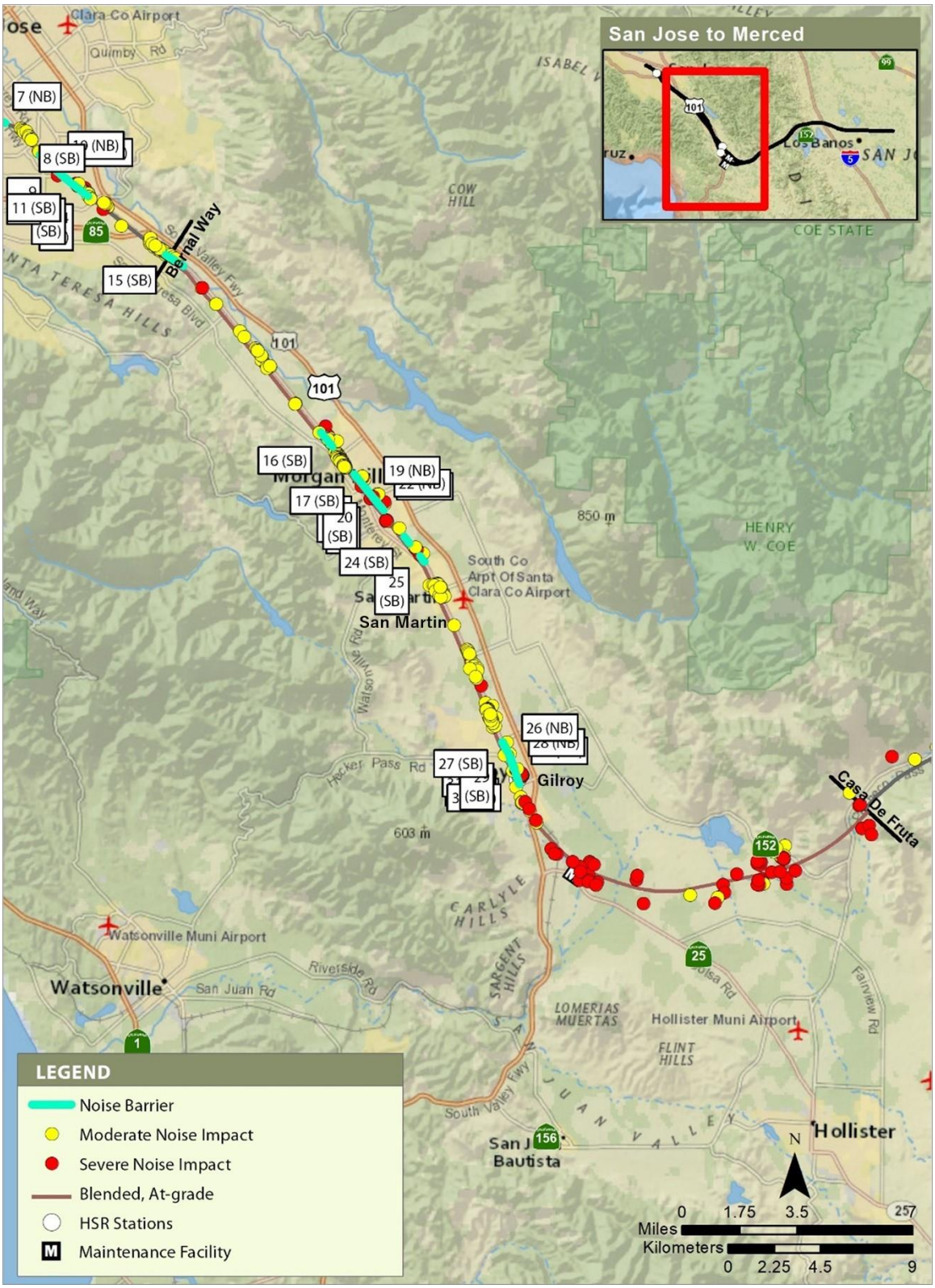
SEPTEMBER 2020

Figure 3.4-40 Proposed Noise Barriers and Residual Noise Impacts—Alternative 4 (Monterey Corridor Subsection)



SEPTEMBER 2020

Figure 3.4-41a Proposed Noise Barriers and Residual Noise Impacts—Alternative 4 without the Tunnel Design Variant (Morgan Hill and Gilroy Subsection)

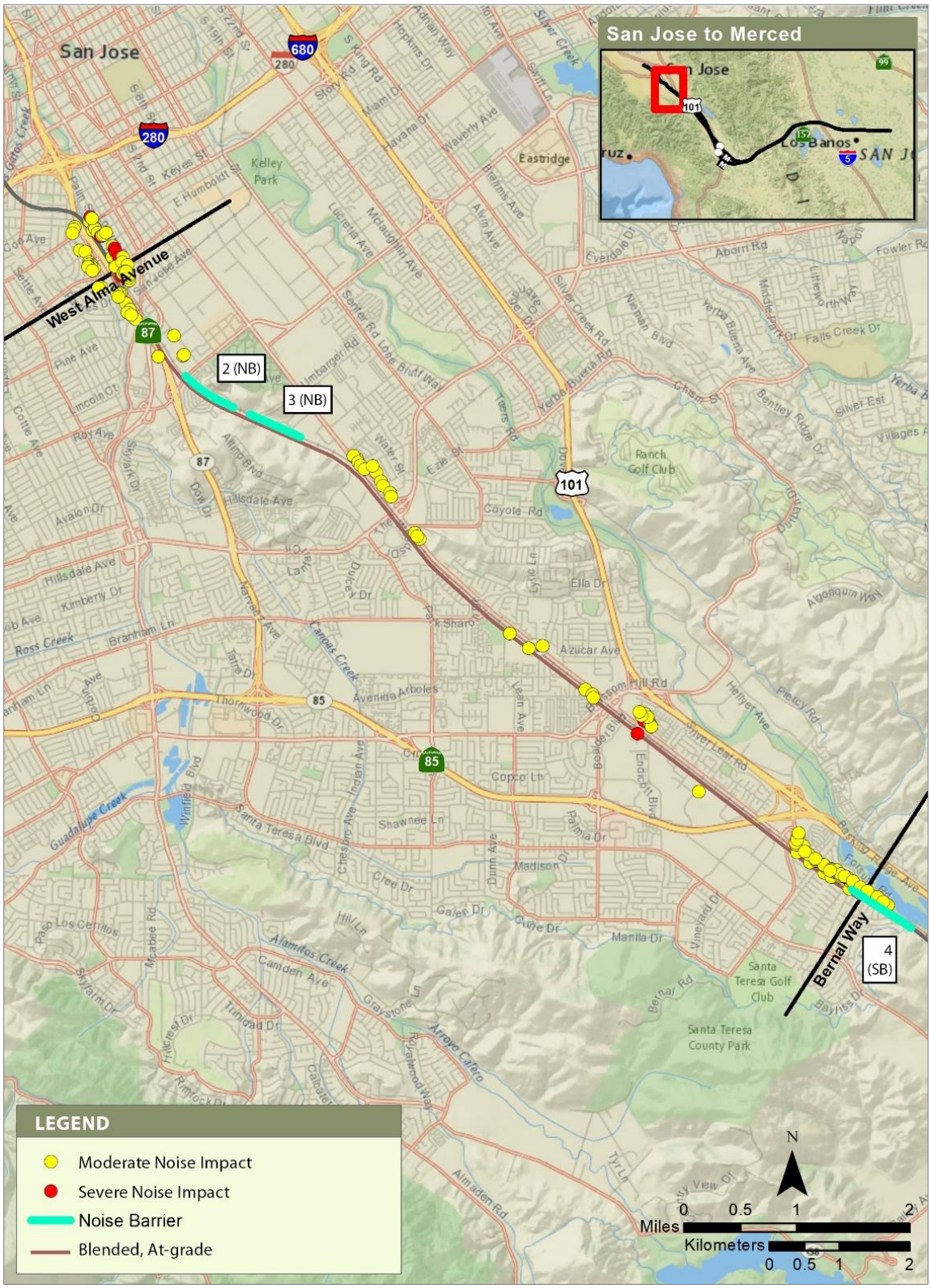


SEPTEMBER 2020

Figure 3.4-41b Proposed Noise Barriers and Residual Noise Impacts—Alternative 4 with the Tunnel Design Variant (Morgan Hill and Gilroy Subsection)

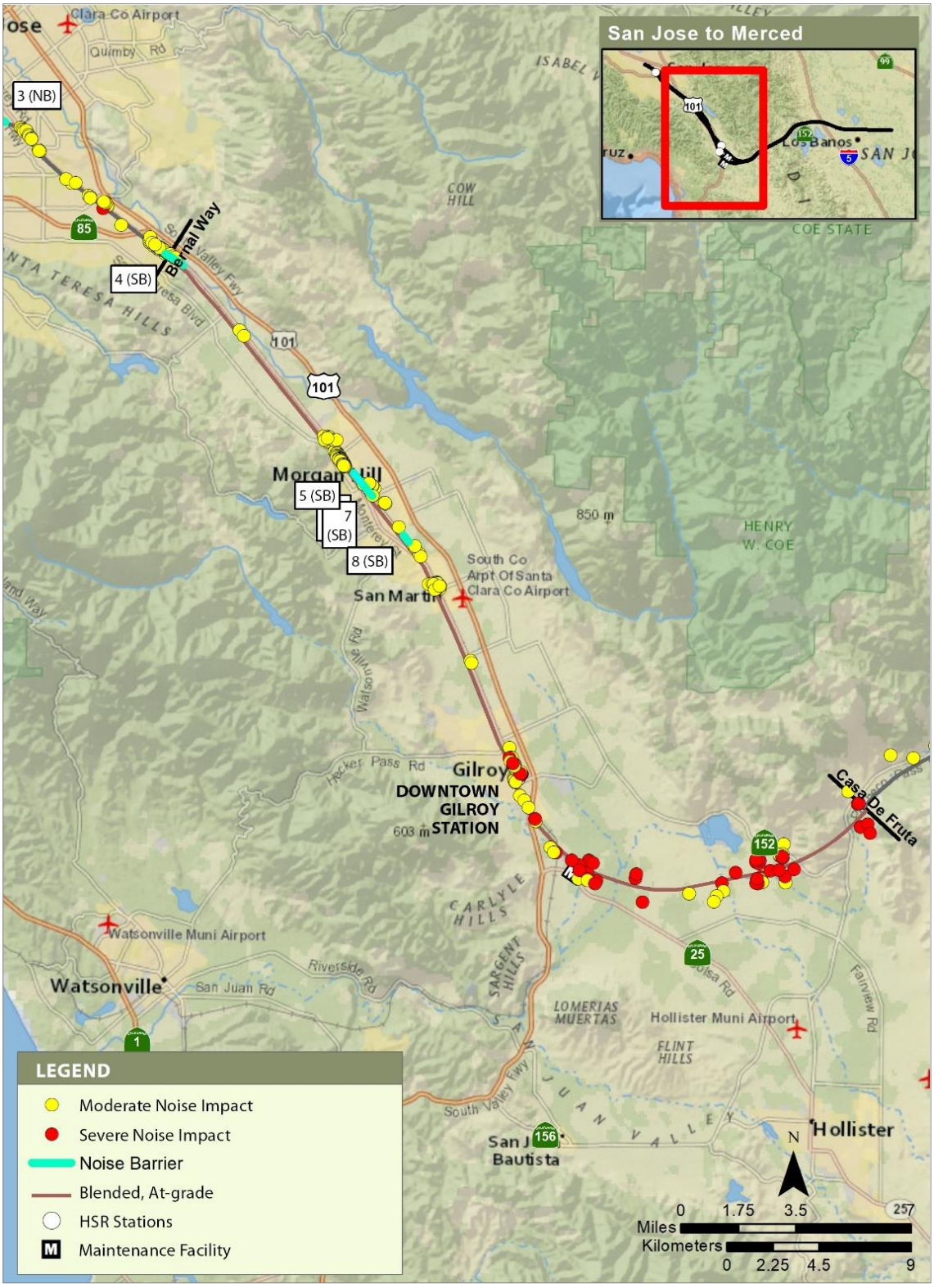
SEPTEMBER 2020

Figure 3.4-42 Proposed Noise Barriers with Quiet Zones and Residual Noise Impacts—Alternative 4 (San Jose Diridon Station Approach Subsection)



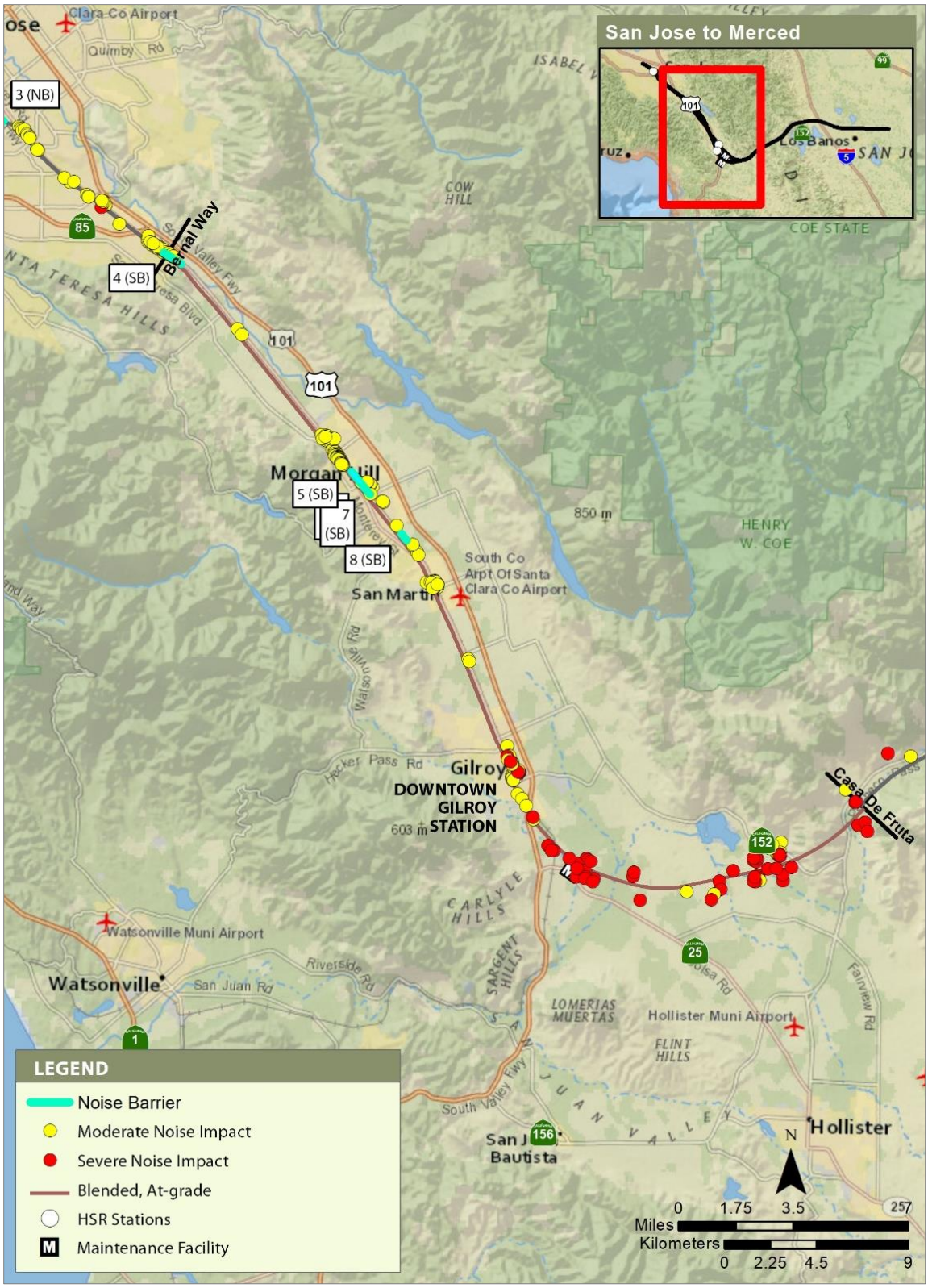
SEPTEMBER 2020

Figure 3.4-43 Proposed Noise Barriers with Quiet Zones and Residual Noise Impacts—Alternative 4 (Monterey Corridor Subsection)



SEPTEMBER 2020

Figure 3.4-44a Proposed Noise Barriers with Quiet Zones and Residual Noise Impacts—Alternative 4 without the Tunnel Design Variant (Morgan Hill and Gilroy Subsection)



SEPTEMBER 2020

Figure 3.4-44b Proposed Noise Barriers with Quiet Zones and Residual Noise Impacts—Alternative 4 with the Tunnel Design Variant (Morgan Hill and Gilroy Subsection)

Table 3.4-27 Proposed Noise Barriers with Quiet Zones—Alternative 4

Barrier	City	Start Stationing	End Stationing	Length (feet)	Height (feet)	Noise Barrier Coverage (square feet)	Side of Track	Number of Severe Impacts Benefited	Number of Moderate Impacts Benefited	Number of Residual Impacts (Severe/ Moderate)
1	Santa Clara & San Jose	2963+00	2973+00	1,000	9	9,000	West	3	1	0 / 0
2	San Jose	3246+00	3275+00	2,900	14	40,600	East	23	61	0 / 0
3	San Jose	3278+00	3309+00	3,100	8	24,800	East	23	4	0 / 0
4	San Jose	644+00	677+00	3,300	8	26,400	West	49	11	0 / 0
5	Morgan Hill	1110+00	1132+00	2,200	10	22,000	West	22	0	0 / 0
6	Morgan Hill	1133+00	1144+00	1,100	10	11,000	West	30	1	0 / 0
7	Morgan Hill	1145+00	1157+00	1,200	10	12,000	West	8	10	0 / 0
8	Morgan Hill	1239+00	1251+00	1,200	10	12,000	West	100	100	0 / 0
Total								**258**	**188**	**0 / 0**

Summary

The analysis investigated noise impacts under each project alternative for the year 2040 for three cases: noise impacts without mitigation, residual noise impacts with noise barriers, and residual noise impacts with noise barriers and Quiet Zones. Quiet Zones, where implemented by local jurisdictions, would eliminate sounding of train horns approaching at-grade crossings. Quiet Zones would not affect HSR train noise where the HSR alignments are on grade-separated sections.

As shown in Table 3.4-28, under Alternative 1, in the San Jose Diridon Station Approach Subsection with and without the DDV, noise barriers would mitigate 17 severe noise impacts and eliminating horn noise would not affect the number of projected noise impacts. In the Monterey Corridor Subsection, noise barriers would eliminate 46 severe noise impacts, but no additional severe noise impacts would be eliminated with Quiet Zones. In the Morgan Hill and Gilroy Subsection with and without the TDV, noise barriers would eliminate 40 severe noise impacts and an additional 8 severe noise impacts could be eliminated with the implementation of quiet zones by local jurisdictions. In the Pacheco Pass Subsection with and without the TDV, no noise barriers are recommended and there is no horn noise. In the San Joaquin Valley Subsection with and without the TDV, noise barriers included in BIO-MM#80 will eliminate two severe noise impacts on individuals sleeping at overnight parking areas at Los Banos and Volta Wildlife Areas, and there is no horn noise.

Table 3.4-28 Noise Mitigation Effectiveness—Alternative 1[1]

Subsection	Alternative 1 Moderate and Severe Noise Impacts					
	Without Mitigation		With Noise Barriers		With Quiet Zones and Noise Barriers	
	Moderate	Severe	Moderate	Severe	Moderate	Severe
San Jose Diridon Station Approach	118	20	13	3	13	3
Monterey Corridor	226	46	85	0	84	0
Morgan Hill and Gilroy	819 (816)[2]	160 (167)	541 (538)	120 (127)	486 (483)	112 (119)
Pacheco Pass	4	10 (11)	4	10 (11)	4	10 (11)
San Joaquin Valley	33 (31)	101 (103)	34 (32)	99 (101)	34 (32)	99 (101)
Total[1]	**1,200 (1,195)**	**337 (347)**	**677 (672)**	**232 (242)**	**621 (616)**	**224 (234)**

[1] The total numbers of impacts shown as benefitted in Table 3.4-23 are not the same as the difference between the numbers in this table with and without mitigation because, while mitigation will reduce noise effects, it may not eliminate them entirely. Thus, a reduced impact may still qualify as a residual moderate or severe impact.
[2] Impacts associated with the design variants are shown in parentheses. The DDV affects Alternative 4 within the San Jose Diridon Station Approach Subsection; the remaining noise impacts are associated with the TDV.

Table 3.4-29 shows noise impacts for Alternative 2 under the same mitigation conditions. In the San Jose Diridon Station Approach Subsection with and without the DDV, analysts found no noise barriers to be cost-effective and eliminating horn noise would not affect the number of projected noise impacts because there are no at-grade crossings. In the Monterey Corridor Subsection, noise barriers would eliminate 46 severe noise impacts, and Quiet Zones would not provide an additional benefit. In the Morgan Hill and Gilroy Subsection with and without the TDV, noise barriers would eliminate 512 severe noise impacts, and Quiet Zones would not provide an additional benefit because all existing at-grade crossings are already eliminated with Alternative 2. In the Pacheco Pass Subsection with and without the TDV, no noise barriers are

recommended and there is no horn noise. In the San Joaquin Valley Subsection with and without the TDV, noise barriers included in BIO-MM#80 will eliminate two severe noise impacts on individuals sleeping at overnight parking areas, and there is no horn noise.

Table 3.4-29 Noise Mitigation Effectiveness—Alternative 2

Subsection	Alternative 2 Moderate and Severe Noise Impacts					
	Without Mitigation		With Noise Barriers		With Quiet Zones and Noise Barriers	
	Moderate	Severe	Moderate	Severe	Moderate	Severe
San Jose Diridon Station Approach	73	0	73	0	73	0
Monterey Corridor	327	46	186	0	186	0
Morgan Hill and Gilroy	1,407 (1,403)[2]	598 (606)	497 (493)	86 (94)	497 (493)	86 (94)
Pacheco Pass	4	10 (11)	4	10 (11)	4	10 (11)
San Joaquin Valley	33 (31)	101 (103)	34 (32)	99 (101)	34 (32)	99 (101)
Total[1]	**1,844 (1,838)**	**755 (766)**	**794 (788)**	**195 (206)**	**794 (788)**	**195 (206)**

[1] The total numbers of impacts shown as benefitted in Table 3.4-24 are not the same as the difference between the numbers in this table with and without mitigation because, while mitigation will reduce noise effects, it may not eliminate them entirely. Thus, a reduced impact may still qualify as a residual moderate or severe impact.
[2] Impacts associated with the design variants are shown in parentheses. The DDV affects Alternative 4 within the San Jose Diridon Station Approach Subsection; the remaining noise impacts are associated with the TDV.

Table 3.4-30 shows noise impacts for Alternative 3 under the same mitigation conditions. In the San Jose Diridon Station Approach Subsection with and without the DDV, no noise barriers were found to be cost-effective and eliminating horn noise would not affect the number of projected noise impacts because there are no at-grade crossings. In the Monterey Corridor Subsection, noise barriers would eliminate 46 severe noise impacts, and no additional severe noise impacts would be eliminated with Quiet Zones. In the Morgan Hill and Gilroy Subsection with and without the TDV, no noise barriers were found to be cost-effective, and no severe noise impacts would be eliminated with Quiet Zones. In the Pacheco Pass Subsection with and without the TDV, no noise barriers are recommended and there is no horn noise. In the San Joaquin Valley Subsection with and without the TDV, noise barriers included in BIO-MM#80 will eliminate two severe noise impacts on individuals sleeping at overnight parking areas at Los Banos and Volta Wildlife Areas, and there is no horn noise.

Table 3.4-30 Noise Mitigation Effectiveness—Alternative 3[1]

Subsection	Alternative 3 Moderate and Severe Noise Impacts					
	Without Mitigation		With Noise Barriers		With Quiet Zones and Noise Barriers	
	Moderate	Severe	Moderate	Severe	Moderate	Severe
San Jose Diridon Station Approach	73	0	73	0	73	0
Monterey Corridor	226	46	85	0	65	0
Morgan Hill and Gilroy	498 (511)[2]	65 (73)	498 (511)	65 (73)	461 (474)	65 (73)

Subsection	Alternative 3 Moderate and Severe Noise Impacts					
	Without Mitigation		With Noise Barriers		With Quiet Zones and Noise Barriers	
	Moderate	Severe	Moderate	Severe	Moderate	Severe
Pacheco Pass	4	10 (11)	4	10 (11)	4	10 (11)
San Joaquin Valley	33 (31)	101 (103)	34 (32)	99 (101)	34 (32)	99 (101)
Total[1]	**834 (845)**	**222 (233)**	**694 (705)**	**174 (185)**	**637 (648)**	**174 (185)**

[1] The total numbers of impacts shown as benefitted in Table 3.4-25 are not the same as the difference between the numbers in this table with and without mitigation because, while mitigation will reduce noise effects, it may not eliminate them entirely. Thus, a reduced impact may still qualify as a residual moderate or severe impact.
[2] Impacts associated with the design variants are shown in parentheses. The DDV affects Alternative 4 within the San Jose Diridon Station Approach Subsection; the remaining noise impacts are associated with the TDV.

Table 3.4-31 shows noise impacts for Alternative 4 under the same mitigation conditions. Under Alternative 4, Quiet Zones would eliminate HSR train horn noise at grade crossings. In the San Jose Diridon Station Approach Subsection with and without the DDV, noise barriers would eliminate 99 severe noise impacts, and an additional 13 severe noise impacts would be eliminated with Quiet Zones. In the Monterey Corridor Subsection, noise barriers would eliminate 273 severe noise impacts, and an additional 12 severe noise impacts would be eliminated with Quiet Zones. In the Morgan Hill and Gilroy Subsection, noise barriers would eliminate 547 severe noise impacts with and without the TDV. An additional 74 severe noise impacts would be eliminated with Quiet Zones without the TDV, and 73 severe noise impacts would be eliminated with Quiet Zones with the TDV. In the Pacheco Pass Subsection with and without the TDV, no noise barriers are recommended and there is no horn noise. In the San Joaquin Valley Subsection with and without the TDV, noise barriers included in BIO-MM#80 will eliminate two severe noise impacts on individuals sleeping at overnight parking areas at Los Banos and Volta Wildlife Areas, and there is no horn noise.

Table 3.4-31 Noise Mitigation Effectiveness—Alternative 4[1]

Subsection	Alternative 4 Moderate and Severe Noise Impacts					
	Without Mitigation		With Noise Barriers		With Quiet Zones and Noise Barriers	
	Moderate	Severe	Moderate	Severe	Moderate	Severe
San Jose Diridon Station Approach	221	136	218	37	216	24
Monterey Corridor	267	293	152	20	110	8
Morgan Hill and Gilroy	1,141 (1,135)[2]	672 (681)	806 (800)	125 (134)	586 (579)	51 (61)
Pacheco Pass	4	10 (11)	4	10 (11)	4	10 (11)
San Joaquin Valley	33 (31)	101 (103)	34 (32)	99 (101)	34 (32)	99 (101)
Total[1]	**1,666 (1,658)**	**1,212 (1,224)**	**1,214 (1,206)**	**291 (303)**	**950 (941)**	**192 (205)**

[1] The total numbers of impacts shown as benefited in Table 3.4-26 and Table 3.4-27 are not the same as the difference between the numbers in this table with and without mitigation because, while mitigation will reduce noise effects, it may not eliminate them entirely. Thus, a reduced impact may still qualify as a residual moderate or severe impact.
[2] Impacts associated with the design variants are shown in parentheses. The DDV affects Alternative 4 within the San Jose Diridon Station Approach Subsection; the remaining noise impacts are associated with the TDV.

The Authority has developed additional information about the potential mitigation effectiveness of sound insulation to reduce indoor noise levels. This additional information does not affect the CEQA significance conclusions of the prior analysis, because the Authority's noise impact criteria relate to outdoor noise levels. Nevertheless, the Authority is providing this information about potential mitigation effectiveness of sound insulation to reduce indoor noise levels. Analysts evaluated the potential mitigation effectiveness of sound insulation to reduce indoor noise levels for receptors that would still experience severe outdoor noise impacts after implementation of feasible noise barriers. The typical building outdoor-to-indoor noise reduction is assumed to be 25 dB. Sound insulation improvements are expected to provide an additional 5 dB of outdoor-to-indoor noise reduction. The indoor acceptable noise threshold for residences is 45 L_{dn} (FTA 2018). Analysts identified locations where sound insulation improvements would and would not be effective where the total future noise with the HSR would be less than or greater than 75 dBA. The analysis, as shown in Table 3.4-312, indicates that implementation of sound insulation at receptors with residual severe noise impacts after implementation of noise barrier mitigation would substantially reduce indoor noise levels at most affected receptors to less than the 45 dBA threshold for indoor noise. With sound insulation, while severe outdoor noise impacts may remain for some receptors, most of those receptors would have indoor noise levels meeting the acceptable threshold.

Table 3.4-32 Sound Insulation Mitigation Effectiveness for Indoor Noise Levels

Alternative	Severe Noise Impacts with Noise Barriers	Receptors with Severe Noise Impacts with Interior Noise Levels <= 45 dBA with Sound Insulation[1,2]	Receptors with Severe Noise Impacts with Interior Noise Levels >= 45 dBA with Sound Insulation[2]
Alternative 1	232 (242)	228 (238)	4 (4)
Alternative 2	195 (206)	194 (205)	1 (1)

Alternative	Severe Noise Impacts with Noise Barriers	Receptors with Severe Noise Impacts with Interior Noise Levels <= 45 dBA with Sound Insulation[1,2]	Receptors with Severe Noise Impacts with Interior Noise Levels >= 45 dBA with Sound Insulation[2]
Alternative 3	174 (185)	173 (184)	1 (1)
Alternative 4	291 (303)	277 (289)	14 (14)

[1] Assumes buildings currently have outdoor-to-indoor noise reduction of 25 dB.
[2] Assumes 5 dB reduction with sound insulation.
Note: Impacts associated with the design variants are shown in parentheses. The DDV would affect Alternative 4 within the San Jose Diridon Station Approach Subsection; the TDV would affect all alternatives within the Morgan Hill and Gilroy, Pacheco Pass, and San Joaquin Valley Subsections.
Alt = alternative
dBA = A-weighted decibel
DDV = Diridon design variant
TDV = tunnel design variant

3.4.7.2 Vibration Mitigation Analysis

Operations vibration impacts will be mitigated with NV-MM#8. This mitigation measure includes various options to reduce train vibration. The specific design and implementation of this mitigation measure would be identified during final design.

As there are site-specific factors to consider, such as the speed, presence of special trackwork, soil type, and vibration propagation characteristics, further studies during the subsequent engineering phases of the project should evaluate these site-specific conditions where vibration mitigation is indicated to determine the mitigation design requirements. Such studies would include additional vibration propagation tests to narrow down the site-specific vibration estimates, and engineering evaluation of the special track support options. Vibration impacts less than 10 dB over the thresholds will be reduced to less than significant levels with mitigation. It may not be possible to fully mitigate vibration impacts that are more than 10 dB over the threshold; as a result, some vibration impacts will be potentially significant and unavoidable with mitigation.

While the precise evaluation of the effectiveness of NV-MM#8 requires detailed designs and consideration of site-specific conditions, vibration mitigation has the potential to reduce the vibration levels by up to 10 dB. A preliminary review of the operational vibration impacts was done to identify the impacts that are more than 10 dB and less than 10 dB above the threshold. Based on the review, there is a potential to reduce all or nearly all of the vibration impacts for Alternatives 1, 2, and 3 to below the threshold and the potential to reduce all but 15 of the vibration impacts for Alternative 4 below the threshold. However, the actual effectiveness of NV-MM#8 can only be determined during the detailed design phase, so this assessment is preliminary only.

3.4.8 Impact Summary for NEPA Comparison of Alternatives

As described in Section 3.1.6.4, the impacts of project actions under NEPA are compared to the No Project Alternative when evaluating the impact of the project alternatives on the resource. The determination of impact is based on the context and intensity of the change that would be generated by project construction and operations. Table 3.4-33 compares the project impacts by alternative and is followed by a summary of the impacts.

Table 3.4-33 Comparison of Project Alternative Impacts for Noise and Vibration

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Noise				
Impact NV#1: Temporary Exposure of Sensitive Receptors to Construction Noise	Temporary noise impacts at noise sensitive locations would exceed the residential nighttime 8-hour L_{eq} criterion of 70 dBA for typical track construction activities up to 374 feet from the clear-and-grub construction activity and up to 774 feet from the concrete pour aerial structure activity. For the PG&E upgrades, these criteria would be exceeded as far away as 522 feet from reconductoring activity. These distances would be applicable to all four project alternatives.	Similar to Alternative 1, with fewer noise impacts in Morgan Hill, Gilroy and Monterey Corridor Subsections.	Similar to Alternative 1, without noise impacts on downtown Gilroy businesses.	Similar to Alternative 1, but no concrete pour aerial structure activity from San Jose to Gilroy. This would have more impacts in Morgan Hill.
Impact NV#2: Intermittent Permanent Exposure of Sensitive Receptors to Noise from Train Operations	Permanent noise impacts from 2029 Plus Project conditions: ▪ 310 (313) moderate noise impacts ▪ 47 (51) severe noise impacts Permanent noise impacts from 2040 Plus Project conditions: ▪ 1,200 (1,195) moderate noise impacts ▪ 337 (347) severe noise impacts	Permanent noise impacts from 2029 Plus Project conditions: ▪ 599 (601) moderate noise impacts ▪ 38 (43) severe noise impacts Permanent noise impacts from 2040 Plus Project: ▪ 1,844 (1,838) moderate noise impacts ▪ 755 (766) severe noise impacts	Permanent noise impacts from 2029 Plus Project conditions: ▪ 227 (233) moderate noise impacts ▪ 34 (37) severe noise impacts Permanent noise impacts from 2040 Plus Project conditions: ▪ 834 (845) moderate noise impacts ▪ 222 (233) severe noise impacts	Permanent noise impacts from 2029 Plus Project conditions: ▪ 1,001 (1,004) moderate noise impacts ▪ 190 (197) severe noise impacts Permanent noise impacts from 2040 Plus Project conditions: ▪ 1,666 (1,658) moderate noise impacts ▪ 1,212 (1,224) severe noise impacts

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact NV#3: Intermittent Permanent Exposure of Sensitive Receptors to Noise from HSR Passenger Station Parking	Noise contribution from parking facilities: ▪ 29 dBA L_{dn} at San Jose Diridon Station ▪ 40 dBA L_{dn} at the Downtown Gilroy Station This additional noise would be substantially lower than noise from HSR trains.	Same as Alternative 1	Noise contribution from parking facilities: ▪ 29 dBA L_{dn} at San Jose Diridon Station ▪ 28 dBA L_{dn} at the East Gilroy Station This additional noise would be substantially lower than noise from HSR trains.	Same as Alternative 1
Impact NV#4: Intermittent Permanent Exposure of Sensitive Receptors to Noise from HSR Maintenance Facilities	40 dBA L_{dn} contribution from train movements at the South Gilroy MOWF, which is substantially lower than the noise from operating HSR trains. No additional impact is projected.	Same as Alternative 1	47 dBA L_{dn} contribution from train movements at the East Gilroy MOWF, which is substantially lower than the noise from operating HSR trains. No additional impact is projected.	45 dBA L_{dn} contribution from train movements at the Alternative 4 South Gilroy MOWF, which is substantially lower than the noise from operating HSR trains. No additional impact is projected.
Impact NV#5: Intermittent Permanent Human Annoyance from Onset of Passing HSR Trains	Operations would not cause human annoyance from the startle effect of HSR train passbys within dedicated sections of the alignment because the threshold for sudden onset noise would occur within the right-of-way, which would be fenced to prohibit public access.	Same as Alternative 1	Same as Alternative 1	Operations would cause initial human annoyance from the startle effect of HSR train passbys at one location within 23 feet of the tracks in Morgan Hill. Effects south and east of Gilroy would be the same as Alternative 1.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact NV#6: Permanent Exposure of Sensitive Receptors to Vehicular Traffic Noise Increases	Roadway segments with an anticipated increase in traffic noise of ≥3 dB compared to existing conditions include: 2029 Plus Project conditions ▪ 4 segments near San Jose ▪ 2 segments along Monterey Road ▪ 1 segment near South Gilroy MOWF 2040 Plus Project conditions ▪ 5 segments near San Jose ▪ 6 segments along Monterey Road ▪ 1 segment near South Gilroy MOWF	Same as Alternative 1	Roadway segments with an anticipated increase in traffic noise of ≥3 dB compared to existing conditions include: 2029 Plus Project conditions ▪ 4 segments near San Jose ▪ 2 segments along Monterey Road 2040 Plus Project conditions ▪ 5 segments near San Jose ▪ 6 segments along Monterey Road ▪ 1 segment near East Gilroy MOWF	Roadway segments with an anticipated increase in traffic noise of ≥3 dB compared to existing conditions include: 2029 Plus Project conditions ▪ 3 segments near San Jose ▪ 3 segments along Monterey Road 2040 Plus Project conditions ▪ 4 segments near San Jose ▪ 6 segments along Monterey Road ▪ 1 segment near Downtown Gilroy Station ▪ 1 segment near South Gilroy MOWF
Impact NV#7: Intermittent Permanent Livestock Stress from Passing HSR Trains	Livestock within 30 feet from the edge of the HSR right-of-way would experience stress associated with exposure to noise levels above the recommended thresholds.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1. Also, livestock at two locations between San Jose and Gilroy within 65 feet of edge of HSR right-of-way would experience stress associated with exposure to noise levels from sounding of HSR horns.
Impact NV#8: Permanent Exposure of Sensitive Receptors to Traction Power Facility Noise	The substation facilities would generate noise, but would not cause additional noise impacts beyond those from trains and horns.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Vibration				
Impact NV#9: Temporary Exposure of Sensitive Receptors and Buildings to Construction Vibration	Potential annoyance from nighttime vibratory methods within 300 feet of residential structures. Potential building damage from impact pile driving within 50 feet of structures. Potential perceptible vibration in occupied buildings within 100 feet of tunnel boring operations for tunnel construction.	Similar to Alternative 1 but potentially more vibratory compaction at embankments and at grade at the Monterey Corridor and Morgan Hill and Gilroy Subsections; less vibratory compaction in San Jose to Scott Blvd touchdown.	Similar to Alternative 1 in Gilroy and in Monterey Corridor Subsection, but eastern alignment in Gilroy and Morgan Hill would affect fewer structures; similar to Alternative 2 in the Monterey Corridor Subsection through San Jose.	Similar to Alternative 1 east of Gilroy; most vibratory compaction at embankments and at-grade portions of all project alternatives; construction in existing right-of-way would require more nighttime work to minimize service disruptions.
Impact NV#10: Intermittent Permanent Exposure of Sensitive Receptors to Vibration from Operations	81 permanent vibration impacts (before mitigation); potential to reduce all or most of these impacts to below the threshold with mitigation.	143 permanent vibration impacts (before mitigation); potential to reduce all or most of these impacts to below the threshold with mitigation.	140 permanent vibration impacts (before mitigation); potential to reduce all or most of these impacts to below the threshold with mitigation.	1,203 permanent vibration impacts (before mitigation); potential to reduce all but 15 of these impacts to below the threshold with mitigation.

≥ = greater than or equal to
dB = decibel
dBA = A-weighted decibel
HSR = high-speed rail
L_{dn} = day night sound level
Leq = equivalent sound level
MOWF = maintenance of way facility
PG&E = Pacific Gas and Electric
Note: Impacts associated with the design variants are shown in parentheses. The DDV would affect Alternative 4 within the San Jose Diridon Station Approach Subsection; the TDV would affect all alternatives within the Morgan Hill and Gilroy, Pacheco Pass, and San Joaquin Valley Subsections.

3.4.8.1 Construction Noise

Project construction would require the use of mechanical equipment that would generate temporary increases in noise and result in temporary construction impacts at noise-sensitive locations. For typical track construction scenarios, the residential nighttime 8-hour L_{eq} criterion of 70 dBA would potentially be exceeded up to 374 feet from the clear-and-grub construction activity and as far as 774 feet from the concrete pour aerial structure activity. For the PG&E upgrades, these criteria would be exceeded as far as 522 feet from the conductor installation construction activity. These distances would be applicable to all four project alternatives. Concrete pour aerial structure activity would not apply to Alternative 4 between San Jose and Gilroy. The Authority and its contractors will comply with FRA guidelines for minimizing noise impacts at sensitive receptors during project construction (NV-IAMF#1), but construction noise impacts will remain. Implementation of NV-MM#1, Construction Noise Mitigation Measures, would reduce these impacts. This mitigation will require the contractor to conduct construction noise monitoring. The measure provides contractors with the flexibility to implement different tools to meet FRA standards for limiting both daytime and nighttime noise during construction.

3.4.8.2 Operations Noise

Project operations would permanently increase noise levels above FRA's noise impact thresholds at sensitive receptors. Alternative 4 would have the most severe and moderate operations noise impacts, followed by Alternative 2, Alternative 1, and Alternative 3, and impacts would be greater under the 2040 Plus Project conditions due to increased HSR train operations compared to 2029. Under the 2040 Plus Project condition without the DDV and TDV, there would be 337 severe noise impacts and 1,200 moderate impacts under Alternative 1; 755 severe impacts and 1,844 moderate impacts under Alternative 2; 222 severe impacts and 834 moderate impacts under Alternative 3; and 1,212 severe impacts and 1,666 moderate impacts under Alternative 4. Under the 2040 Plus Project condition with the DDV and TDV, there would be 347 severe noise impacts and 1,195 moderate impacts under Alternative 1; 766 severe impacts and 1,838 moderate impacts under Alternative 2; 233 severe impacts and 845 moderate impacts under Alternative 3; and 1,224 severe impacts and 1,658 moderate impacts under Alternative 4. The Authority has identified multiple mitigation measures that will reduce the number of sensitive receptors subject to moderate and severe impacts from train operations: NV-MM#3, NV-MM#4, NV-MM#5, NV-MM#6, and NV-MM#7, as described in Section 3.4.7, Mitigation Measures, and BIO-MM#80, as described in Section 3.7.8, Mitigation Measures.

Project operations would generate traffic and associated noise at HSR stations. Near the San Jose Diridon Station, the L_{dn} contribution from the relocated parking spaces would be 29 dBA at the closest noise receptors. Near the Downtown Gilroy Station, the L_{dn} contribution from the parking facilities would be 40 dBA at the closest noise receptors. Near the East Gilroy Station, the L_{dn} contribution from the parking facilities would be 28 dBA at the closest noise receptors. The additional noise from parking facilities would be substantially lower (at least 17 dB less) than the projected L_{dn} from project operations. Therefore, no additional noise impacts from parking facilities are anticipated.

Project operations would also generate additional noise associated with train movements in and out of the MOWF near Gilroy. Under Alternatives 1 and 2, the L_{dn} contribution from the South Gilroy MOWF at that nearest receptor would be 40 dBA (more than 20 dBA less than project operations). Under Alternative 3, the L_{dn} contribution from the East Gilroy MOWF at that nearest receptor would be 47 dBA (more than 20 dBA less than project operations). Under Alternative 4, the L_{dn} contribution from the MOWF at that nearest receptor would be 45 dBA (more than 18 dBA less than project operations). Therefore, no additional noise impacts from MOWFs are anticipated.

Project construction would result in permanent changes in the local roadway network that would require some diversion and rerouting of traffic. The diversion of traffic would not be expected to affect noise levels because traffic on local roadways provides only a minor contribution to overall noise levels. Project operations would generate additional traffic and traffic-related noise under the 2029 Plus Project and 2040 Plus Project conditions. Permanent increases in traffic-related

noise would be similar for all four project alternatives and would occur at roadways segments near San Jose Diridon Station, along Monterey Road, and near Gilroy. In 2029, seven roadway segments under Alternatives 1 and 2 and six roadway segments under Alternatives 3 and 4 would have the potential for noise level increases greater than or equal to 3 dB, compared to existing noise conditions. In 2040, operations of all project alternatives would result in 12 roadway segments with the potential for noise level increases greater than or equal to 3 dB. Most of these traffic noise impacts would occur near the San Jose Diridon Station and along Monterey Road. Mitigation measures NV-MM#3 and NV-MM#7 will address these impacts.

Human annoyance due to startle would be limited to areas within the project's proposed right-of-way except for one residential location with Alternative 4. Analysts also evaluated the potential for livestock animals to experience stress associated with the noise of passing trains in exceedance of FRA's recommended threshold. Where livestock operations are within approximately 30 feet of the edge of the HSR right-of-way, adverse impacts would occur. With Alternative 4, adverse impacts on livestock at two locations between San Jose and Gilroy would occur within approximately 65 feet of HSR tracks where HSR trains would sound warning horns at the at-grade crossings.

Project operations would also generate additional noise associated with TPF facilities. Under all project alternatives, the L_{dn} contribution from these facilities would not generate additional noise impact beyond the train operations noise impacts. The most combined HSR train operation and TPF impacts would occur with Alternative 4 (33 severe, 0 moderate) near the traction power paralleling stations in San Jose, Morgan Hill, and Gilroy; followed by Alternative 3 (8 severe, 1 moderate) and Alternative 1 (6 severe, 1 moderate) in Morgan Hill and Gilroy; and then Alternative 2 (1 severe, 0 moderate) in Gilroy. Mitigation measures NV-MM#3 and NV-MM#7 will address these impacts.

3.4.8.3 Construction Vibration

Project construction would cause temporary exposure of sensitive receptors and buildings to construction vibration. Building damage could occur within approximately 50 feet of pile driving. Additionally, construction of the HSR tunnels in the Pacheco Pass Subsection would cause temporary perceptible vibration in occupied buildings within approximately 100 feet of the tunnel boring machine operation. Incorporation of NV-IAMF#1 will minimize construction vibration and the potential for it to cause damage to buildings. However, even with NV-IAMF#1, some sensitive receptors will still be exposed to ground-borne vibration that could result in building damage. This impact will be addressed with NV-MM#2.

Using the frequent event criterion, annoyance from nighttime vibratory construction activities would occur as far out as 300 feet from pile driving or 140 feet from vibratory compaction. Incorporation of NV-IAMF#1 will minimize construction vibration and the potential for it to cause annoyance to occupants at vibration-sensitive land use. However, even with NV-IAMF#1, some sensitive receptors will still be exposed to ground-borne vibration that will result in annoyance during nighttime hours. The residual impact will be addressed with NV-MM#2.

3.4.8.4 Operations Vibration

Project operations would cause permanent vibration annoyance impacts at sensitive receptors. Alternative 1 would result in 81 vibration impacts, Alternative 2 would result in 143 vibration impacts, Alternative 3 would result in 140 vibration impacts, and Alternative 4 would result in 1,203 vibration impacts. Most of these vibration impacts would occur in the Monterey Corridor Subsection, with the remaining vibration impacts occurring in the San Jose Diridon Station Approach and Morgan Hill and Gilroy Subsections. NV-MM#8 will address these impacts. As described in Section 3.4.7.2, there is the potential to reduce all vibration impacts for Alternatives 1, 2, and 3 to below the threshold and the potential to reduce all but 15 of the vibration impacts for Alternative 4 below the threshold.

3.4.9 CEQA Significance Conclusions

As described in Section 3.4.4.5, the impacts of project actions under CEQA are evaluated against thresholds to determine whether a project action would result in no impact, a less than significant impact, or a significant impact. Table 3.4-34 identifies the CEQA significance determinations for each impact discussed in Sections 3.4.6.2, Noise, and 3.4.6.3, Vibration. A summary of the significant impacts, mitigation measures, and factors supporting the significance conclusion after mitigation follows the table.

Table 3.4-34 CEQA Significance Conclusions and Mitigation Measures for Noise and Vibration

CEQA Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measure	CEQA Level of Significance after Mitigation
Noise			
Impact NV#1: Temporary Exposure of Sensitive Receptors to Construction Noise	Significant for all project alternatives. Construction activity noise would exceed FRA standards at sensitive receptors.	NV-MM#1: Construction Noise Mitigation Measures	Significant and Unavoidable for all project alternatives
Impact NV#2: Intermittent Permanent Exposure of Sensitive Receptors to Noise from Train Operations	Significant for all project alternatives. Operations noise would exceed FRA standards at sensitive receptors.	NV-MM#3: Implement Proposed California High-Speed Rail Project Noise Mitigation Guidelines NV-MM#4: Support Potential Implementation of Quiet Zones by Local Jurisdictions NV-MM#5: Vehicle Noise Specification NV-MM#6: Special Trackwork at Crossovers, Turnouts, and Insulated Joints NV-MM#7: Additional Noise Analysis during Final Design BIO-MM#80: Minimize Permanent Intermittent Noise, Visual, and Train Strike Impacts on Wildlife Movement	Significant and Unavoidable for all project alternatives
Impact NV#3: Intermittent Permanent Exposure of Sensitive Receptors to Noise from HSR Passenger Station Parking	Less than significant for all project alternatives. Additional noise would be substantially lower than noise from HSR trains. No additional impact is projected.	No mitigation measures are required.	N/A

CEQA Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measure	CEQA Level of Significance after Mitigation
Impact NV#4: Intermittent Permanent Exposure of Sensitive Receptors to Noise from HSR Maintenance Facilities	Less than significant for all project alternatives.	No mitigation measures are required.	N/A
Impact NV#5: Intermittent Permanent Human Annoyance from Onset of Passing HSR Trains	Less than significant for Alternatives 1, 2 and 3. Alternative 4 would have potential to expose one residential location to sudden onset noise above the threshold level, which would be a significant impact at that location.	NV-MM#3: Implement Proposed California High-Speed Rail Project Noise Mitigation Guidelines NV-MM#7: Additional Noise Analysis during Final Design	Less than Significant.
Impact NV#6: Permanent Exposure of Sensitive Receptors to Vehicular Traffic Noise Increases	Significant for all project alternatives. Additional vehicular traffic at HSR stations and MOWFs would increase ambient noise levels in the project vicinity above levels existing without the project.	NV-MM#3: Implement Proposed California High-Speed Rail Project Noise Mitigation Guidelines NV-MM#7: Additional Noise Analysis during Final Design	Significant and Unavoidable for all project alternatives

CEQA Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measure	CEQA Level of Significance after Mitigation
Impact NV#7: Intermittent Permanent Livestock Animal Stress from Passing HSR Trains	Less than significant for all project alternatives. Impacts limited to within 30 feet of the edge of the HSR right-of-way for train passbys (all project alternatives). Unconfined livestock could avoid high noise levels by moving away from the track as trains approach and noise from passbys would be short. Confined animals could move away from the tracks in some cases and could become habituated to train noise. Livestock in two areas between San Jose and Gilroy would experience additional horn soundings with Alternative 4, but the horn soundings would be similar to existing train horn noise-sounding events and are not expected to result in substantial new stress compared to existing conditions.	No mitigation measures are required.	N/A
Impact NV#8: Permanent Exposure of Sensitive Receptors to Traction Power Facility Noise	Significant for all project alternatives in combination with other project noise. The substation facilities would not affect new receptors beyond those identified in Impact NV#2.	NV-MM#3: Implement Proposed California High-Speed Rail Project Noise Mitigation Guidelines NV-MM#7: Additional Noise Analysis during Final Design	Less than Significant with Mitigation
Vibration			
Impact NV#9: Temporary Exposure of Sensitive Receptors and Buildings to Construction Vibration	Significant for all project alternatives. Project construction could expose buildings to excessive ground-borne vibration and would exceed nighttime annoyance ground-borne vibration criterion for residential building occupants.	NV-MM#2: Construction Vibration Mitigation Measures	Less than Significant for all project alternatives

CEQA Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measure	CEQA Level of Significance after Mitigation
Impact NV#10: Intermittent Permanent Exposure of Sensitive Receptors to Vibration from Operations	Significant for all project alternatives. Project operations would generate excessive ground-borne vibration impacts at sensitive receptors.	NV-MM#8: Project Vibration Mitigation Measures	Significant and Unavoidable for all project alternatives (although preliminary review indicates that most, if not all, significant impacts for Alternatives 1, 2, and 3 may be avoided with mitigation and for Alternative 4 all but 15 significant impacts may be avoided with mitigation)

CEQA = California Environmental Quality Act
FRA = Federal Railroad Administration
HSR = high-speed rail
MOWF = maintenance of way facility
N/A = not applicable

Impact NV#1: Temporary Exposure of Sensitive Receptors to Construction Noise

There would be a significant impact under CEQA for all project alternatives, with and without the DDV and TDV, because construction activities would affect sensitive receptors by temporarily and periodically substantially increasing ambient noise levels in the project vicinity. The DDV would be constructed closer to a few sensitive receptors east of the construction area north of the SAP Center. The alternatives would incorporate NV-IAMF#1 to minimize noise impacts by requiring compliance with FRA guidelines for minimizing construction noise and vibration impacts when work is conducted within 1,000 feet of sensitive receptors. However, even with NV-IAMF#1, some sensitive receptors will be exposed to construction noise that exceeds FRA guidelines. Mitigation to address this impact is included in Section 3.4.7, Mitigation Measures, and the Authority would implement NV-MM#1 to reduce the potential for construction noise impacts. This mitigation measure will require the contractor to prepare a noise-monitoring program and noise control plan prior to construction to comply with the FRA construction noise limits wherever feasible. The monitoring program would describe the actions the contractor would use to reduce noise, such as installing temporary noise barriers, avoiding nighttime construction near residential areas, and using low-noise emission equipment. Implementation of this mitigation measure would reduce construction noise levels but not always below the FRA noise standards, particularly at night and during pile driving. Therefore, the impact would be significant and unavoidable for all project alternatives. Under Alternative 4 with the DDV, there may be a few additional receptors that could be subject to such unavoidable effects under CEQA during construction.

Impact NV#2: Intermittent Permanent Exposure of Sensitive Receptors to Noise from Train Operations

There would be a significant impact under CEQA for all project alternatives because project operations would increase noise levels above existing ambient levels and in exceedance of FRA criteria, causing severe noise impacts at sensitive receptors. The number of severe impacts would vary by alternative, as summarized in Table 3.4-35, with the most noise impacts occurring under Alternative 4, followed by Alternative 2, Alternative 1, and Alternative 3.

Table 3.4-35 Noise Mitigation Effectiveness

Project Alternative	2040 Noise Impacts without Mitigation		Noise Impacts with Noise Barriers		Noise Impacts with Quiet Zones and Noise Barriers	
	Moderate	Severe	Moderate	Severe	Moderate	Severe
Alternative 1	1,200 (1,195)	337 (347)	677 (672)	232 (242)	621 (616)	224 (234)
Alternative 2	1,844 (1,838)	755 (766)	794 (788)	195 (206)	794 (788)	195 (206)
Alternative 3	834 (845)	222 (233)	694 (705)	174 (185)	637 (648)	174 (185)
Alternative 4	1,666 (1,658)	1,212 (1,224)	1,214 (1,206)	291 (303)	950 (941)	192 (205)

1. TPF impacts would occur at receptors already identified for HSR train operations as follows: Alternative 1: 6 severe, 1 moderate; Alternative 2: 1 severe, no moderate; Alternative 3: 8 severe, 1 moderate; Alternative 4: 33 severe, 0 moderate.
2. The total numbers of impacts shown as benefitted in Table 3.4-23 through Table 3.4-27 are not the same as the difference between the numbers in this table with and without mitigation because, while mitigation will reduce noise effects, it may not eliminate them entirely. Thus, a reduced impact may still qualify as a residual moderate or severe impact.
3. Impacts associated with the design variants are shown in parentheses. The DDV affects Alternative 4 within the San Jose Diridon Station Approach Subsection; the TDV affects all alternatives within the Morgan Hill and Gilroy, Pacheco Pass, and San Joaquin Valley Subsections.
HSR = high-speed rail
TPF = traction power facility

Mitigation to address this impact is included in Section 3.4.7, Mitigation Measures. The Authority would implement mitigation measures to minimize operations noise impacts. As part of NV-MM#3, Implement Proposed California High-Speed Rail Project Noise Mitigation Guidelines, the Authority will consider constructing noise barriers, supporting implementation of Quiet Zones where cities decide to implement them, installing sound insulation, or acquiring easements on properties severely affected by noise, based on criteria in the Authority's Noise and Vibration Mitigation Guidelines (Volume 2, Appendix 3.4-B). These measures will reduce or compensate for severe noise impacts from operations. As part of NV-MM#4, Support Potential Implementation of Quiet Zones by Local Jurisdictions, the Authority will assist local communities in establishing Quiet Zones to reduce noise impacts from train warning horns. NV-MM#5, Vehicle Noise Specification, will require HSR vehicles to meet federal regulations for noise (40 C.F.R. § 201.12) at the time of procurement. NV-MM#6, Special Trackwork at Crossovers, Turnouts, and Insulated Joints, will require the contractor to document how they minimized or eliminated rail gaps related to special trackwork, which can be a major source of noise during operations. As part of NV-MM#7, Additional Noise Analysis during Final Design, if any changes to final design or vehicle specifications change any assumptions underlying the noise analysis, the Authority will prepare the necessary environmental documentation as required by NEPA and CEQA to reassess potential impacts and mitigation. These mitigation measures will all be effective at reducing the number of severe noise impacts in the RSA; however, they will not mitigate all noise impacts. Table 3.4-35 summarizes the noise impacts that could be mitigated with noise barriers, and with a combination of noise barriers and Quiet Zones. As specified in the noise mitigation guidelines (see Appendix 3.04-B), noise barriers should be approved by 75 percent affected parties in a community; if they do not approve, then noise barriers may not be installed at certain locations. Quiet zones cannot be implemented by the Authority or any rail operators (like Caltrain); they can only be established at the initiative of a local jurisdiction. Thus, quiet zones may not be advanced where local jurisdictions do not want them to be established.

Mitigation to address this impact is also included in Section 3.7.8, Mitigation Measures. As part of BIO-MM#80, Minimize Permanent Intermittent Noise, Visual, and Train Strike Impacts on Wildlife Movement, the Authority will consider constructing noise barriers to address the impact of noise on avian and mammalian wildlife, which will also mitigate this impact.

Because severe noise impacts will remain following mitigation and/or noise barriers or quiet zones would not be implemented due to the constraints noted above, the impact will be significant and unavoidable under CEQA.

For the TPF, noise barriers will be considered as part of NV-MM#3, and equipment selection and site design will be considered as part of NV-MM#7 to reduce noise from transformers and other sources within the traction power facilities.

Impact NV#5: Intermittent Permanent Human Annoyance from Onset of Passing HSR Trains

Alternative 4 would have a significant impact related to startle at one residential location in Morgan Hill where the residence is within 23 feet of the proposed track alignment. Mitigation to address this impact is included in Section 3.4.7, Mitigation Measures. The Authority would implement mitigation measures to minimize operations noise impacts. As part of NV-MM#3, Implement Proposed California High-Speed Rail Project Noise Mitigation Guidelines, the Authority will consider constructing noise barriers, installing sound insulation, or acquiring easements on properties severely affected by noise, based on criteria in the Authority's Noise and Vibration Mitigation Guidelines (Volume 2, Appendix 3.4-B). As part of NV-MM#7, additional noise analysis during final design could refine or reduce the impact by incorporating more detailed train speed, track design, and actual vehicle noise characteristics. These mitigation measures will lower the amount of resultant train noise, which will also address the severity of rapid onset of noise at the one identified significant location and, thus, this impact will be mitigated to a less than significant level.

Impact NV#6: Permanent Exposure of Sensitive Receptors to Vehicular Traffic Noise Increases

There would be a significant impact under CEQA for all project alternatives because project operations would permanently expose sensitive receptors to traffic noise increases from additional traffic near the HSR stations, MOWF, and some roadways in the Monterey Corridor Subsection. A total of seven roadway segments under Alternatives 1 and 2 and six roadway segments under Alternatives 3 and 4 would have the potential for noise level increases greater than or equal to 3 dB compared to existing noise conditions in 2029. By 2040, 12 roadway segments would have the potential for noise level increases greater than or equal to 3 dB for all four project alternatives. Mitigation to address this impact is included in Section 3.4.7, Mitigation Measures. The Authority would implement mitigation measures to minimize impacts from traffic noise increases. As part of NV-MM#3, Implement Proposed California High-Speed Rail Project Noise Mitigation Guidelines, the Authority will investigate the traffic noise impacts and ways to mitigate them by means such as noise barriers. As part of NV-MM#7, Additional Noise Analysis during Final Design, if any changes to final design or vehicle specifications change any assumptions underlying the noise analysis, the Authority will prepare the necessary environmental documentation as required by NEPA and CEQA to reassess impacts and mitigation. These mitigation measures will reduce the traffic noise impacts, but will not mitigate all traffic noise impacts. Therefore, the impact would be significant and unavoidable.

Impact NV#8: Permanent Exposure of Sensitive Receptors to Traction Power Facility Noise

There would be a significant impact under CEQA for all project alternatives because project operations would permanently expose sensitive receptors to severe noise increase from TPF sites in San Jose, Morgan Hill, and Gilroy for the combined condition of TPF and HSR trains and other project noise. Under Alternative 4, 30 residences in a San Jose multifamily building would be exposed to a noise increase that exceeds the 2.9 dBA threshold for the TPF and the HSR trains; in Gilroy, the 3.6 dBA threshold would increase at 2 homes and the 2.8 dBA threshold would increase at 1 home. Under Alternative 3, five single-family residences in Morgan Hill would be exposed to a noise increase that exceeds the 3.4 dBA threshold; in Gilroy a school would be exposed to noise that exceeds the 2.5 dBA threshold and two homes would be exposed to noise that exceeds their respective thresholds of 2.7 and 2.8 dBA. Under Alternative 2, one Gilroy residence would be exposed to noise that exceeds the threshold of 2.8 dBA. Under Alternative 1,

five single-family residences in Morgan Hill would be exposed to a noise increase that exceeds the 3.4 dBA threshold; in Gilroy, one residence would be exposed to noise that exceeds the threshold of 2.8 dBA. Mitigation to address this impact is included in Section 3.4.7, Mitigation Measures; the Authority would implement mitigation measures to minimize impacts from TPF noise. As part of NV-MM#3, Implement Proposed California High-Speed Rail Project Noise Mitigation Guidelines, the Authority will investigate the TPF noise impacts and ways to mitigate them by means such as noise barriers around the facility. As part of NV-MM#7, Additional Noise Analysis during Final Design, additional design considerations such as equipment selection and siting will be evaluated during final design if needed to mitigate the noise. These mitigation measures will mitigate all severe noise impacts from TPF. Therefore, the impact will be less than significant with mitigation.

Impact NV#9: Temporary Exposure of Sensitive Receptors and Buildings to Construction Vibration

There would be a significant impact under CEQA for all project alternatives because construction activities would expose persons and could expose buildings to excessive ground-borne vibration from pile driving and possibly other construction activities such as vibratory compaction. Incorporation of NV-IAMF#1 will minimize construction vibration and its potential to cause damage to buildings and human annoyance. However, even with NV-IAMF#1, some sensitive receptors will be exposed to ground-borne vibration that will result in annoyance, and buildings could be exposed to vibration that exceeds the FRA vibration damage criteria. Mitigation to address this impact is included in Section 3.4.7, Mitigation Measures. The Authority would implement NV-MM#2, Construction Vibration Mitigation Measures, to minimize vibration impacts from construction. As part of this mitigation measure, the contractor will develop and implement vibration reduction methods whenever impact pile driving or other high-vibration-producing activity will occur within 50 feet of any building to meet the FRA criteria. Prior to starting pile driving and other high-vibration activity, the contractor would conduct pre-construction surveys within 50 feet of the activity to document the existing condition of buildings in case damage is reported during or after construction. The contractor would arrange for the repair of damaged buildings or would pay compensation to the property owner. These measures will avoid or offset vibration impacts from construction. Therefore, the impact would be less than significant for all project alternatives.

Impact NV#10: Intermittent Permanent Exposure of Sensitive Receptors to Vibration from Operations

There would be a significant impact under CEQA for all project alternatives because project operations would generate excessive ground-borne vibration impacts at sensitive receptors in the San Jose Diridon Station Approach and Monterey Corridor Subsections. Alternative 1 would result in 81 vibration impacts, Alternative 2 would result in 143 vibration impacts, Alternative 3 would result in 140 vibration impacts, and Alternative 4 would result in 1,203 vibration impacts. Mitigation to address this impact is included in Section 3.4.7, Mitigation Measures. The Authority would implement NV-MM#8, Project Vibration Mitigation Measures, to minimize vibration impacts from operations. There are various options to reduce train vibration, although it may not be possible in all instances to mitigate all vibration impacts. The specific design and implementation of this mitigation measure would be identified during final design. As described in Section 3.4.7.2, based on a preliminary analysis there is the potential to reduce nearly all or all vibration impacts for Alternatives 1, 2, and 3 to below the threshold and the potential to reduce all but 15 of the vibration impacts for Alternative 4 below the threshold. However, the specific effectiveness of NV-MM#8 cannot be fully determined until detailed design is conducted, and these estimates are preliminary. Therefore, the impact would be significant and unavoidable.

There would be no building damage impacts from project operations.

3.5 Electromagnetic Fields and Electromagnetic Interference

Since publication of the Draft Environmental Impact Report (EIR)/Environmental Impact Statement (EIS), the following substantive changes have been made to this section:

- Section 3.5.2.1, Federal, was updated regarding the Federal Railroad Administration (FRA) Procedures for Considering Environmental Impacts. Footnotes were added regarding FRA's Environmental Procedures and the updated Council on Environmental Quality (CEQ) regulations issued after release of the Draft EIR/EIS.
- A clarification comparing the modeled high-speed rail (HSR) magnetic field strengths with measured ambient levels was added to Section 3.5.5.3, Sensitive Receptors and Facilities.
- Analysis about the Diridon design variant (DDV) and tunnel design variant (TDV), which was included in Section 3.20 in the Draft EIR/EIS, was incorporated into Impact EMF/EMI#1.
- Text was added to Impact EMF/EMI#2 to describe magnetic field strengths in the resource study area (RSA) and to clarify that higher speeds associated with the design variants would lead to slightly higher electromagnetic field strength.
- Impact EMF/EMI#10 was modified slightly to clarify EMI effects on airports.
- Table 3.5-14 was modified to incorporate the slightly higher field strength that would be generated with the design variants.
- Where appropriate, the verb "would," when used specifically to describe impact avoidance and minimization features (IAMFs) or mitigation measures, as well as their directly related activities, was changed to "will," indicating their integration into project design.

3.5.1 Introduction

This section describes electromagnetic fields (EMF) and electromagnetic interference (EMI), provides information on how these fields are measured, identifies standards that regulate these fields, and evaluates the potential for construction and operation of HSR in the San Jose to Central Valley Wye Project Extent (project or project extent) to affect potentially sensitive receptors.

In order to reduce the EMF/EMI from the HSR Traction Electrification System, the Authority is installing a 2x25-kilovolt (kV) Autotransformer System that includes a negative feeder (NF) wire located above the overhead contact system (OCS) and running parallel to it. This power configuration allows the majority of the traction power return current to flow in the NF, rather than the running rails. This considerably reduces the size of the current loop, and results in a corresponding reduction in the electromagnetic field.

Analysts identified current and projected sources of EMFs in the RSA based upon field surveys, a review of aerial imagery and government agency databases, and a review of local and state general plans. In addition, analysts identified potentially sensitive receptors within the RSA that may be susceptible to EMFs and EMI produced by the California HSR System. These receptors include adjacent railroads and rail transit systems, airports, residential dwellings, schools, preschools and daycare facilities, public parks, hospitals, commercial and industrial facilities, and agricultural operations (farms), including confined animal agriculture.

Purpose

Electromagnetic interference (EMI) is the disruption of operation of an electronic device when it is in the vicinity of an electromagnetic field (EMF) in the radio frequency (RF) spectrum that is caused by another electronic device. This EMI/EMF analysis was performed to protect sensitive equipment near the proposed alignments and inform the public with regards to any potential health impacts from construction and operation of the project.

The EMF and EMI impacts from construction and operation of the project evaluated in this analysis include: exposure of people to EMF and EMI (including future passengers, workers, and neighbors), exposure of livestock to EMF and EMI, interference with electromagnetically sensitive

equipment, radio interference, electric shock risks, corrosion potential, interference with adjacent railroads, and interference with adjacent airports.

The following appendices in Volume 2 of this Final EIR/EIS provide additional details on EMF and EMI:

- Appendix 2-D, Applicable Design Standards, describes the relevant design standards for this project.
- Appendix 2-E, San Jose to Merced Project Section Impact Avoidance and Minimization Features, provides the list of all IAMFs incorporated into the project.
- Appendix 2-J, San Jose to Merced Project Section Regional and Local Plans and Policies, provides a list by resource of all applicable regional or local plans and policies.
- Appendix 3.5-A, Preconstruction Electromagnetic Measurement Survey of Locations along the San Jose to Merced Project Section, documents measurement results from a preconstruction electromagnetic survey.

EMF and EMI conditions in the project extent are important because of the potential impacts on the operation of electrical, magnetic, and electromagnetic devices. The following EIR/EIS resource sections provide additional information related to EMFs and EMI:

- Section 3.2, Transportation, evaluates impacts of the project alternatives on rail operations within the project extent.
- Section 3.6, Public Utilities and Energy, evaluates impacts of the project alternatives on public utilities and electric transmission facilities within the project extent.
- Section 3.11, Safety and Security, evaluates impacts of the project alternatives on the safety and security of adjacent communities along the project extent.

3.5.1.1 Definition of Terminology

EMFs are electric and magnetic fields. Electric fields are forces that electric charges exert on other electric charges. Magnetic fields are forces that a magnetic object or moving electric charge exerts on other magnetic materials and electric charges. EMFs occur throughout the electromagnetic spectrum, are found in nature, and are generated both naturally and by human activity. Naturally occurring EMFs include the earth's magnetic field, static electricity, and lightning. EMFs are also created by the generation, transmission, and distribution of electricity; the use of everyday household electric appliances and communication systems; and industrial processes.

Definitions

EMFs are electric and magnetic fields.

Electric fields are forces that electric charges exert on other electric charges.

Magnetic fields are forces that a magnetic object or moving electric charge exerts on other magnetic materials and electric charges.

EMI is the interference that occurs when the EMF produced by a source adversely affects the operation of an electrical, magnetic, or electromagnetic device.

EMI is the interference that occurs when the EMF produced by a source adversely affects the operation of an electrical, magnetic, or electromagnetic device. EMI may be caused by a source that intentionally radiates EMFs (such as a television broadcast station) or one that does so incidentally (such as an electric motor). The information presented in this section primarily concerns EMFs at the 60 Hertz (Hz) power frequency and at radio frequencies produced intentionally by communications or unintentionally by electric discharges.

EMFs from the HSR operation would consist of the following:

- **Power-frequency electric and magnetic fields from the traction power system and electrical infrastructure**—The traction power system and electrical infrastructure comprise traction power substations (TPSS), switching stations, paralleling stations, electrical lines, emergency generators that provide backup power to the stations in case of power outages,

and utility feeder lines. The 25- kV operating voltage of the HSR traction power system would produce 60 Hz electric fields, and 60 Hz magnetic fields would be produced by the flow of currents providing power to the HSR vehicles. Along the tracks, magnetic fields would be produced by the flow of propulsion current to the trains in the OCS and the return current in the NF and the rails.

- **Harmonic magnetic fields from vehicles**—Depending upon the design of power equipment in the HSR trains, power electronics would produce currents with frequencies in the kilohertz (kHz) range. Potential sources include power conversion units, switching power supplies, motor drives, and auxiliary power systems. Unlike the traction power system, these sources are highly localized in the trains and move along the track with the trains.
- **Radio frequency (RF) fields**—RF fields are any of the electromagnetic wave frequencies in the range from around 3 kHz to 300 gigahertz (GHz), and they include those frequencies used for communications or radar signals. The HSR system would use a variety of communications, data transmission, and monitoring systems—both on and off vehicles—that operate at radio frequencies. These wireless systems would meet the Federal Communications Commission (FCC) regulatory requirements for intentional emitters (47 Code of Federal Regulations [C.F.R.] Part 15 and FCC Office of Engineering Technology Bulletin No. 65, *Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields)*.

Of these EMFs, the dominant effect is expected to result from the 60 Hz alternating current (AC) magnetic fields from the propulsion current flowing in the traction power system—that is, the OCS, NF, and rails. These concepts are discussed in more detail in the following sections.

3.5.1.2 Characteristics of Electromagnetic Radiation

The electromagnetic (EM) spectrum consists of two types of radiation: ionizing and nonionizing. A wave's position on the EM spectrum depends on its wavelength. Ionizing radiation—capable of removing electrons from atoms, and thus of damaging biological tissues—consists of short-wave or high-frequency radiation, including ultraviolet, x-ray, and gamma ray radiation. Nonionizing radiation consists of long-wave radiation, including radio waves, microwaves, and infrared radiation. Visible light is the portion of the EM spectrum that lies between the infrared (nonionizing) and ultraviolet (ionizing) portions of the EM spectrum. This section addresses the potential impacts that nonionizing, long-wave electromagnetic radiation (EMR) at wavelengths below those of visible light can have on human health and on sensitive electric and electronic equipment and facilities along the project extent.

Nonionizing EMR consists of waves characterized by variations in electric fields (measured in volts per meter (V/m) and magnetic fields (measured in Tesla [T] or Gauss [G]). These periodic waves move through a medium, such as air, transferring energy from place to place as they go. The waves move at the speed of light and have dimensions of height, or amplitude; wavelength, or the distance between two adjacent peaks of the wave; and number of cycles per second (Hz), or frequency. Table 3.5-1 shows wavelengths for a range of different frequencies. Table 3.5-2 shows the magnetic field strengths of electrical devices and facilities commonly found in urban areas.

Table 3.5-1 Relationship between Typical Frequencies and Their Wavelengths

Frequency	Wavelength
1 Hz	186,000 miles
60 Hz	3,100 miles
10 kHz	18.6 miles
10 MHz	98.4 feet
100 MHz	9.8 feet

Hz = Hertz
kHz = Kilohertz
MHz = Megahertz

Table 3.5-2 Typical Magnetic Field Strengths

Electrical Source	Magnetic Field Strength at 1 Foot (mG)
Dishwasher	30
Hair Dryer	70
Electric Shaver	100
Vacuum Cleaner	200
High-Voltage Power/Transmission Line (115 kV-500 kV)	30–87[a]
Medium-Voltage Power Distribution Line (4 kV-24 kV)	10–70[a]

Source: NIEHS 2002
mG = milligauss
kV = kilovolts
[a] = Standing beneath the lines, for typical conductor heights for these line voltages

Naturally occurring EMFs consist of both electric fields and magnetic fields that are generated by the sun, lightning, biological processes, and currents within the Earth's molten metallic core. Artificial EMFs are intentionally generated by electrical devices, such as television and radio broadcasting towers, hand-held radios, X-ray machines, microwave links, and cellular phones. EMFs of human origin are also unintentionally generated by devices such as electric power transmission and distribution lines, televisions, computers, appliances, ignition systems, and electrical wiring and switches.

While both direct current (DC) and AC electrical devices generate EMFs, the magnetic flux density[1] is much higher for DC than for AC current. The strength of an electric field is proportional to the strength of its electric charge (voltage), while the strength of a magnetic field is proportional to the motion of the charge (current); when no current is flowing in an electrical circuit, only the electrical field is present. The power of an electromagnetic field (i.e., the rate at which energy is transferred) is measured in Watts (W), and the power density (power distributed over a given cross-sectional area perpendicular to the direction of its flow) of the field is measured in Watts per square meter.

Electrical devices generate both near-field and far-field EMFs. Nonradiative near-field behaviors of EMFs dominate close to the device (e.g., within 1–2 wavelengths of their sources), while far-field behaviors dominate at greater distances. Near-field EM strength decreases in proportion to increasing distance from the source, while far-field EM strength decreases in proportion to the square of increasing distance from the source (the so-called *inverse-square law*).

[1] The amount of magnetic flux (the number of magnetic field lines passing through a closed surface, such as a conducting coil, through a unit area taken perpendicular to the direction of the magnetic flux).

EMF Frequencies

EMFs are described in terms of their frequency, which is the number of times the EMF increases and decreases in intensity each second. The U.S. commercial electric power system operates at a frequency of 60 Hz, or 60 cycles per second, meaning that the field increases and decreases in intensity 60 times per second. Electric power system components are typical sources of electric and magnetic fields. These components include generating stations and power plants, substations, high-voltage transmission lines, and electric distribution lines. Even in areas not adjacent to transmission lines, 60 Hz EMFs are generated by electric power systems and building wiring, electrical equipment, and appliances.

Unit Definitions and Conversions

Hertz (Hz) – Unit of frequency equal to one cycle per second

1 kilohertz (kHz) = 1,000 Hz

1 gigahertz (GHz) = 1 billion Hz

Gauss (G) – Unit of magnetic flux density (intensity) (English units)

1 G = 1,000 milligauss (mG)

Tesla (T) – Unit of magnetic flux density (intensity) (International units)

1 T = 1 million microtesla (µT)

1 G = 100 µT

1 mG = 0.1 µT

Natural and anthropogenic EMFs cover a broad frequency spectrum. EMFs that are nearly constant in time are called DC EMFs. EMFs that vary in time are called AC EMFs. AC EMFs are further characterized by their frequency range. Extremely low frequency (ELF) magnetic fields are typically defined as having a lower limit of 3–30 Hz and an upper limit of 30–3,000 Hz. The HSR OCS and electrical transmission, power, and distribution system would primarily generate ELF fields at 60 Hz and at harmonics (multiples) of 60 Hz.

Radio and other communications operate at much higher frequencies, often in the range of 500,000 Hz (500 kHz) to 3 GHz. Typical RF sources of EMFs include antennas on cellular telephone towers; radio and television broadcast towers; airport radar, navigation, and communication systems; high-frequency (HF) and very high-frequency (VHF) communication systems used by police, fire, emergency medical technicians, utilities, and governments and local wireless systems, such as wireless fidelity (WiFi) and cordless telephones.

The strength of magnetic fields is measured either in milligauss (mG), G, T, or microtesla (µT). For comparison, Earth's ambient magnetic field ranges from 500 to 700 mG DC (0.5 to 0.7 G) (50 to 70 µT) at its surface. Average AC magnetic field levels in homes are approximately 1 mG (0.001 G) (0.1 µT), and measured AC values range from 9 to 20 mG (0.009 to 0.020 G) (0.9 to 2 µT) near appliances (Severson et al. 1988). The strength of an EMF rapidly decreases with distance from its source; thus, EMFs higher than background levels are usually found close to EMF sources. For overhead transmission and power lines, the strength of an EMF is typically the highest directly under the overhead line and decreases rapidly with increasing distance from the line. Table 3.5-3 shows the typical EMF levels from overhead electrical lines at varying lateral distances from the line tower. EMF levels at a distance of 200 feet from a 230-kV transmission line and a 115-kV power line are reduced by approximately 97 and 99 percent, respectively.

Table 3.5-3 Typical EMF Levels for Transmission/Power Lines

Voltage of Source	Field Strength at Specified Distances from Source				
	At Source	50 feet	100 feet	200 feet	300 feet
230-kV transmission line electric field strength (kV/m)	2.0	1.5	0.3	0.05	0.01
230-kV transmission line mean magnetic field (mG)	57.5	19.5	7.1	1.8	0.8
115-kV power line electric field strength (kV/m)	1.0	0.5	0.07	0.01	0.003
115-kV power line mean magnetic field (mG)	29.7	6.5	1.7	0.4	0.2

Source: NIEHS 2002
EMF = electromagnetic field
kV = kilovolt
kV/m = kilovolts per meter
mG = milligauss

EMF Exposure and Health Effects

EMFs can cause EMI, which can disrupt sensitive equipment (e.g., implanted medical devices), possibly triggering a malfunction. At sufficiently high exposure levels, EMFs also directly affect human health. Extensive research on EMFs has led the majority of scientists and health officials to conclude that low frequency EMFs have no adverse health effects at typical exposure levels encountered in urban, suburban, or rural living environments. Scientific reviews of animal studies, from which some human health risks have been extrapolated, have also concluded that existing data are inadequate to indicate a potential risk of cancer, which is the primary human health concern associated with EMF exposure (IARC 2002; WHO 2007). However, EMF exposure and the potential adverse health effects, remains a human health concern (WHO 2007).

3.5.1.3 Electromagnetic Interference

General Considerations

EMI is an electromagnetic disturbance from an external source that interrupts or degrades the performance of an electrical device, circuit, or signal. Ambient EMI occurs when EMR intentionally or unintentionally jams, or blocks, another EM signal in free space. Hardware EMI occurs when EMR induces an unintended current in an electrical circuit. To interfere with a radio or microwave signal, the EMI must be at or near the signal frequency. Radio and other communications systems typically operate in the range of 500 kHz to 3 GHz.

Commercial standards developed for electromagnetic compatibility (EMC) both limit EMI generated by electrical devices and reduce susceptibility of electrical devices to external EMI. For example, the Federal Aviation Administration's (FAA) interim EMC commercial standards require aircraft systems to withstand EMFs of up to 200 V/m (FAA 2014).

EMI and Radio Communications

Intentional radio signals exist in a sea of unwanted radio frequency noise, so radio communications systems and devices are designed to operate in this environment. General frequency ranges are assigned for various types of radio signals, and specific radio frequencies and power output levels are assigned to individual users to minimize the potential for disruptions. Radio equipment is designed to separate the frequency of interest from background noise and to reject transient or unfocused signals.

EMI and Sensitive Equipment

Research equipment is generally designed to operate within the Earth's natural magnetic field and to compensate for fluctuations of up to 10 mG in that field (University of Michigan 2009). Industries associated with the use, assembly, calibration, or testing of sensitive or unshielded RF equipment, however, are still sensitive to EMI. In particular, fluctuations in the magnetic field can interfere with nuclear magnetic resonance (NMR), nuclear magnetic imaging, and other imaging equipment, such as electron microscopes. Computed tomography and computed axial tomography scanning devices are also sensitive to EMI, as are some semiconductor, nanotechnology, and biotechnology operations. NMR spectrometers are sensitive to time-varying DC magnetic fields of less than 2 mG (Field Management Services 2009). For unshielded equipment that is sensitive to magnetic fields in the range of 1–3 mG, such as magnetic resonance imaging (MRI) systems, electromagnetic interference is possible at distances of up to 200 feet. An installation guide for NMR equipment recommends a separation distance of 100 meters (328 feet) from electric trains (Field Management Services 2009).

3.5.2 Laws, Regulations, and Orders

Federal and state laws, regulations, and orders applicable to EMF and EMI are presented below. The California High-Speed Rail Authority (Authority) would implement the HSR project, including this project extent, in compliance with all federal and state regulations. Regional and local laws, regulations, and orders considered in preparing this analysis are provided in Appendix 2-J.

Additionally, several organizations have developed guidelines for EMF exposure, including individual states, the FCC, Occupational Safety and Health Administration (OSHA), Institute of Electrical and Electronics Engineers (IEEE), American National Standards Institute (ANSI), and American Conference of Governmental Industrial Hygienists (ACGIH). Neither the California government nor the U.S. government has regulations limiting EMF exposure to residences.

EMF exposure guidelines and standards have also been adopted by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) in the ELF and RF frequency bands applicable to HSR emissions. The ICNIRP and IEEE standards both address EMF exposure by the general public for the United States and abroad (and have been formally adopted by the European Union); the IEEE standards have been identified in the *Final Program EIR/EIS for the Proposed California High-Speed Train System* (Statewide Program EIR/EIS) (Authority and Federal Railroad Administration [FRA] 2005) to assess the potential for health and compatibility effects from anticipated HSR emissions. For occupational exposure, ICNIRP recommended exposure limits are 417 µT for magnetic fields and 8.333 kV/m (kilovolts per meter) for 60 Hz electric fields (ICNIRP 1998).

The IEEE Standard C95.6, *IEEE Standard for Safety Levels With Respect to Human Exposure to Electromagnetic Fields, 0–3 kHz*, which is often referenced in the United States and has been formally adopted by ANSI, specifies maximum permissible exposure (MPE) levels for the general public and for occupational exposure to extremely low-frequency EMFs, which have frequencies of 0 to 3 kHz. The HSR electrification and traction power systems would generate extremely low frequency EMFs with frequencies of 60 Hz, which are in the range covered by this standard. The IEEE Standard C95.6 exposure levels are shown in Table 3.5-4 and Table 3.5-5. Note that the IEEE exposure levels are recommendations only, not regulations.

Table 3.5-4 IEEE C95.6 Magnetic Field Maximum Permissible Exposure Levels for the General Public

Body Part	Frequency Range (Hz)	B-Field (mG)
Head and torso	20–759	9.04×10^3
	759–3,000	$6.87 \times 10^6/f$
	60	9.04×10^3
Arms or legs	<10.7	3.53×10^6
	10.7–3,000	$3.79 \times 10^7/f$
	60	632,000

Source: IEEE 2002
/f = divide by the frequency
Hz = hertz
IEEE = Institute of Electrical and Electronics Engineers
mG = milligauss

Table 3.5-5 IEEE C95.6 Electric Field Maximum Permissible Exposure Levels for the General Public

Body Part	Frequency Range (Hz)	E Field (V/m)
Whole body	1–368	5,000
	368–3,000	$1.84 \times 10^6/f$
	60	5,000

Source: IEEE 2002
/f = divide by the frequency
Hz = hertz
IEEE = Institute of Electrical and Electronics Engineers
V/m = volts per meter

In 2006, ANSI adopted IEEE Standard C95.1 as its standard for safe human exposure to nonionizing electromagnetic radiation (IEEE 2006). The HSR train control and communications systems would use radio signals within the range covered by this standard. The C95.1 Standard specifies MPE levels for whole and partial body exposure to electromagnetic energy. MPE exposure levels are lower at 100 to 300 megahertz (MHz) because the human body absorbs the greatest percentage of incident energy at these frequencies. The MPE standards become progressively higher at frequencies above 400 MHz because the human body absorbs less energy at these higher frequencies. The IEEE C95.1 Standard MPEs are based upon RF levels averaged over a 30-minute exposure time for the general public. For occupational exposure, the averaging time varies with frequency from 6 minutes at 450 MHz to 3.46 minutes at 5,000 MHz.

Both the IEEE C95.6 and C95.1 standards specify safety levels for occupational and general-public exposure. For each, the exposure levels are frequency dependent. The general-public exposure safety levels are stricter because workers are assumed to have knowledge of occupational risks and are better equipped to protect themselves (e.g., through use of personal safety equipment). The general-public safety levels are intended to protect all members of the public (including pregnant women, the unborn, infants, and the infirm) from short- and long-term exposure to EMFs. The safety levels are also set at 10 to 50 times below the levels at which scientific research has shown harmful effects may occur, thus incorporating a large safety factor (IEEE 2006).

OSHA safety standards for occupational exposure to RF emissions are found at 29 C.F.R. Part 1910.97. The OSHA safety levels do not vary with frequency and are less stringent than the equivalent ANSI/IEEE and FCC MPEs, except for occupational exposure to fields with frequencies above 5,000 MHz, where the OSHA MPE is equal to the C95.1 MPE and is twice that of the FCC MPE. The OSHA MPEs are based upon a 6-minute averaging time.

The American Council of Governmental Industrial Hygienists (ACGIH 2015) provides that occupational exposures should not exceed 10 G (10,000 mG or 1 µT). ACGIH additionally recommends that workers with pacemakers should not exceed 1 G (1,000 mG or 0.1 µT). The ACGIH 10 G guideline level is intended to prevent effects such as induced currents in cells or nerve stimulation. However, the ACGIH guidelines are for occupational exposure, not general public exposure.

3.5.2.1 Federal

U.S. Department of Transportation, Federal Railroad Administration, Procedures for Considering Environmental Impacts (64 Federal Register 28545)

On May 26, 1999, FRA released *Procedures for Considering Environmental Impacts* (FRA 1999). These FRA procedures supplement the Council on Environmental Quality Regulations (40 C.F.R. Part 1500 et seq.) and describe the FRA's process for assessing the environmental impacts of actions and legislation proposed by the agency and for the preparation of associated documents (42 U.S. Code 4321 et seq.).[2,3] The FRA *Procedures for Considering Environmental Impacts* states that "the EIS should identify any significant changes likely to occur in the natural environment and in the developed environment. The EIS should also discuss the consideration given to design quality, art, and architecture in project planning and development as required by U.S. Department of Transportation Order 5610.4." These FRA procedures state that an EIS should consider possible impacts from EMFs and EMI.

[2] While this EIR/EIS was being prepared, FRA adopted new NEPA compliance regulations (23 C.F.R. 771). Those regulations only apply to actions initiated after November 28, 2018. See 23 C.F.R. 771.109(a)(4). Because this EIR/EIS was initiated prior to that date, it remains subject to FRA's Environmental Procedures rather than the Part 771 regulations.

[3] The Council on Environmental Quality issued new regulations on July 14, 2020, effective September 14, 2020, updating the NEPA implementing procedures at 40 C.F.R. Parts 1500-1508. However, this project initiated NEPA before the effective date and is not subject to the new regulations, relying on the 1978 regulations as they existed prior to September 14, 2020. All subsequent citations to Council on Environmental Quality regulations in this environmental document refer to the 1978 regulations, pursuant to 40 C.F.R. 1506.13 (2020) and the preamble at 85 Fed. Reg. 43340.

U.S. Department of Transportation, Federal Railroad Administration (49 C.F.R. Part 236.8, 238.225, 229 Appendix F, and 236 Appendix C)

These regulations provide rules, standards, and instructions regarding operating characteristics of electromagnetic, electronic, or electrical apparatus and safety standards for passenger equipment.

U.S. Environmental Protection Agency, U.S. Presidential Executive Order (USEO) 13045, Protection of Children from Environmental Health Risks and Safety Risks

USEO 13045, issued in 1997, directs federal agencies to make it a priority to identify and assess environmental health and safety risks that may disproportionally affect children and to ensure that policies, programs, activities, and standards address disproportionate risks to children, including risks from EMF exposure.

U.S. Department of Commerce, FCC (47 C.F.R. Part 15)

Part 15 provides rules and regulations regarding licensed and unlicensed RF transmissions. Most telecommunications devices sold in the United States, whether they radiate intentionally or unintentionally, must comply with Part 15. However, Part 15 does not govern any device used exclusively in a vehicle, including in HSR trains.

U.S. Department of Commerce, FCC, Office of Engineering and Technology Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields (FCC 1997)

This bulletin provides assistance in evaluating whether proposed or existing transmitting facilities, operations, or devices comply with limits for human exposure to RF fields adopted by the FCC (FCC 1997).

U.S. Department of Commerce, FCC (47 C.F.R. Part 2.106, Allocation, Assignment, and Use of Radio Frequencies)

This regulation specifies and regulates allowed uses of the radio spectrum within the United States. The frequency allocations extend from 9 kHz to nearly 300 GHz.

U.S. Department of Commerce, FCC (47 C.F.R. Part 1.1310, *Radiofrequency Radiation Exposure Limits*)

The FCC regulations at 47 C.F.R. Part 1.1310 are based upon the 1992 version of ANSI/IEEE C95.1 safety standard. Table 3.5-6 shows MPE contained in the ANSI/IEEE C95.1 and FCC standards at frequencies of 450, 900, and 5,000 MHz, which covers the range of frequencies that may be used by HSR radio systems. FCC MPEs are based upon an average time of 30 minutes for exposure of the general public and 30 minutes for occupational exposure. As shown in Table 3.5-6, the differences between the ANSI/IEEE C95.1 and FCC MPEs are minor.

Table 3.5-6 Radio Frequency Emissions Safety Levels Expressed as Maximum Permissible Exposure

Frequency	ANSI/IEEE C95.1 MPE (mW/cm^2)		FCC MPE (mW/cm^2)		OSHA MPE (mW/cm2)
	Occupational	General Public	Occupational	General Public	Occupational
450 MHz	1.5	0.225	1.5	0.3	10
900 MHz	3.0	0.45	3.0	0.6	10
5,000 MHz	10	1.0	5.0	1.0	10

Sources: IEEE 2006; 47 C.F.R. Part 1.1310, Table 1 (FCC); 29 C.F.R. Part 1910.97 (OSHA)
IEEE = American National Standards Institute/Institute of Electrical and Electronics Engineers
cm = centimeter
FCC = Federal Communications Commission
MHz = megahertz
MPE = maximum permissible exposure

mW/cm² = milliwatts per square centimeter
OSHA = Occupational Safety and Health Administration

U.S. Department of Labor, OSHA (29 C.F.R. Part 1910.97, *Nonionizing Radiation*)

29 C.F.R. Part 1910.97 provides safety standards for occupational exposure to RF emissions in the 10 MHz to 100 GHz range. Table 3.5-6 shows MPEs contained in the OSHA standards. The OSHA safety levels do not vary with frequency and are less stringent than the equivalent ANSI/IEEE and FCC MPEs, except for occupational exposure to fields with frequencies above 5,000 MHz, where the OSHA MPE is equal to the C95.1 MPE and is twice that of the FCC MPE. The OSHA MPEs are based upon averaging over any 6-minute time interval.

3.5.2.2 State

California Department of Education, California Code of Regulations, Title 5, Section 14010(c)

This regulation sets minimum distances for siting school facilities from the edge of power line easements: 100 feet for 50 kV to 133 kV line, 150 feet for 220 kV to 230 kV line, and 350 feet for 500 kV to 550 kV line.

California Public Utilities Commission EMF Guidelines for Electrical Facilities

The California Public Utilities Commission (CPUC) guidelines, based upon D.93-11-013 and D.06-01-042, establish priorities among land use classes for EMF mitigation. While the CPUC decisions, general orders, and guidelines do not directly apply to HSR, they are listed because the project consists of modifications to existing Pacific Gas and Electric Company (PG&E) facilities subject to the jurisdiction of the CPUC. Similarly, reconductoring and other electrical infrastructure modifications would occur pursuant to the CPUC General Order (GO) 95 (Rules for Overhead Electric Line Construction) and GO 174 (Rules for Electric Utility Substations).

Decision D.93-11-013

The CPUC decision adopted a policy regarding EMFs from regulated utilities.

Decision D.06-01-042

The August 2004 CPUC decision updates the EMF policy originally defined in D.93.11.013. D.06-01-042 re-affirmed D.93-11-013 in that health hazards from exposures to EMF have not been established and that state and federal public health regulatory agencies have determined that setting numeric exposure limits is not appropriate. The CPUC also reaffirmed that the existing no-cost and low-cost precautionary-based EMF policy be continued. D.06-01-042 ordered the utilities to convene a workshop to develop standard approaches for design guidelines, including a standard table showing EMF mitigation measures and costs.

3.5.2.3 Regional and Local

All regional and local policies that are applicable to the project are listed in Volume 2, Appendix 2-J. The EMF and EMI standards included in regional and local policies restate, or incorporate by reference, the MPE limits and EMI guidelines set forth in federal and state regulations and industry standards described in Section 3.5.2.1, Federal, and Section 3.5.2.2, State.

3.5.3 Consistency with Plans and Laws

As indicated in Section 3.1.6.3, Consistency with Plans and Laws, the California Environmental Quality Act (CEQA) and CEQ regulations require a discussion of inconsistencies or conflicts between a proposed undertaking and federal, state, regional, or local plans and laws. Accordingly, this Final EIR/EIS describes the inconsistency of the project alternatives with federal, state, regional, and local plans and laws to provide planning context.

Several federal and state laws and implementing regulations listed in Section 3.5.2.1, Federal, and Section 3.5.2.2, State, govern compliance with EMF limits for construction projects and transportation facilities. EMF assessments are highly technical, and several published federal and state guidance documents address how to assess potential impacts. A summary of the federal and state requirements considered in this analysis follows:

- FRA rules, standards, and instructions for operating characteristics of electric and electronic equipment
- FRA safety standards for passengers
- U.S. Executive Order prioritizing protection of children from environmental health and safety risks FCC rules for licensed and unlicensed radio frequency transmissions
- FCC guidelines for safe EMF exposure and regulations for radio frequency emission safety levels
- FCC regulations for allocating, assigning, and using radio frequencies
- OSHA standards for permissible worker exposure to non-ionizing radiation
- California regulations on minimum siting distances of power lines from schools
- CPUC decisions that set EMF policies

The Authority, as the lead agency proposing to construct and operate the HSR system, is required to comply with all federal and state laws and regulations and to secure all applicable federal and state permits prior to initiating construction of the selected alternative. Therefore, there would be no inconsistencies between the project and these federal and state laws and regulations.

The Authority is a state agency, and therefore is not required to comply with local land use and zoning regulations; however, it has endeavored to design and construct the HSR project so that it is compatible with land use and zoning regulations. For example, the Authority would coordinate design and routing of power transmission and distribution lines and facilities with public utility companies and would take local land use into consideration in the routing of these facilities.

Analysts reviewed 10 regional and local planning and policy documents, with 1 plan (Merced County General Plan) and 4 municipal ordinances containing relevant policies and regulations (Volume 2, Appendix 2-J). The project alternatives are consistent with all goals and policies of these ordinances because they would provide adequate electricity, communications, and telecommunications facilities to serve existing and future needs of the system, and these facilities would not create EMI that would interfere with sensitive equipment, emergency services, or transportation systems, including air traffic. The Authority would coordinate with state and local authorities and utilities during design and construction so that critical services would not be affected by EMI. In addition, the project alternatives would be designed to avoid health risks associated with EMF. The project would be consistent with all goals and policies as listed in Appendix 2-J.

3.5.4 Methods for Evaluating Impacts

The evaluation of impacts from EMF and EMI is a requirement of CEQA, and because EMI impacts for the project are reasonably foreseeable, the National Environmental Policy Act (NEPA) requires that they be evaluated as well. The following sections define the RSA and describe the methods used to establish EMF and EMI baseline conditions along the project extent to determine the potential EMF and EMI impacts associated with project construction and operations. The methods combine data collection, electromagnetic field survey, and mathematical modeling to predict EMF levels from HSR operations.

3.5.4.1 Definition of Resource Study Area

As defined in Section 3.1, Introduction, RSAs are the geographic boundaries within which the environmental investigations specific to each resource topic were conducted. The RSA for EMF

and EMI comprises the project footprint for each of the project alternatives, plus 500 feet from the track centerline;[4] 500 feet from the perimeter of the maintenance of way facility, and 500 feet from TPSS facilities, interconnection facilities, and existing PG&E facilities to be modified. The EMF and EMI analysis focuses on the impacts of source EMFs and EMI on sensitive receptors, which include adjacent railroads and rail transit systems, airports, residential dwellings, schools, preschools and daycare facilities, public parks, hospitals, commercial and industrial facilities, and agricultural operations (farms).

The 500-foot screening distance of the RSA was defined based upon typical screening distances identified in the Authority Technical Memoranda (TM) 300.07, *EIR/EIS Assessment of the CHST Alignment EMF Footprint* (Footprint Report) (Authority 2012), and project-specific factors. The screening distances in the Footprint Report were used to identify EMF- and EMI-sensitive receptors that might be near enough to the proposed alignment for EMF or EMI impacts to be possible under typical conditions, and the Footprint Report determined that EMF and EMI impacts would be unlikely where sensitive receptors are located beyond these screening distances.

3.5.4.2 Impact Avoidance and Minimization Features

IAMFs are project features that are considered to be part of the project and are included as applicable in each of the alternatives for purposes of the environmental impact analysis. The full text of the IAMFs that are applicable to the project is provided in Appendix 2-E. The following IAMFs are applicable to the EMF and EMI analysis:

- EMI/EMF-IAMF#1: Preventing Interference with Adjacent Railroads
- EMI/EMF-IAMF#2: Controlling Electromagnetic Fields/Electromagnetic Interference

This environmental impact analysis considers these IAMFs as part of the project design. Within Section 3.5.6, Environmental Consequences, each impact narrative describes how these project features are applicable and, where appropriate, effective at avoiding or minimizing potential impacts to less than significant under CEQA.

3.5.4.3 Methods for Impact Analysis

Overview of Impact Analysis

This section describes the sources and methods the Authority used to analyze potential project impacts from EMFs and EMI on sensitive receptors. These methods apply to both NEPA and CEQA analyses unless otherwise indicated. Refer to Section 3.1.6.4, Methods for Evaluating Impacts, for a description of the general framework for evaluating impacts under NEPA and CEQA. Sections 3.5.4.3 and 3.5.4.4 describe the NEPA and CEQA impact methodologies used to evaluate project impacts from EMFs and EMI. Laws, regulations, and orders (see Section 3.5.2) that regulate EMFs and EMI were also considered in the evaluation of impacts.

Regional and Local Sources of EMFs and EMI

Analysts referred to aerial imagery, surveys, photographs, and FCC databases to identify regional and local sources of EMFs and EMI. Analysts also referred to published reports, such as the *Final EIR for the Peninsula Corridor Electrification Project* (PCJPB 2015), to evaluate existing conditions within the EMF and EMI RSA. The baseline EMF conditions assume the electrification of Caltrain service (as part of the proposed Caltrain Peninsula Corridor Electrification Project [PCEP]) from Scott Boulevard in Santa Clara to Tamien Station in San Jose, requiring the installation of an OCS system and supporting traction power distribution facilities, which is expected to be complete by 2021. The PCEP encompasses all of the San Jose Diridon Station Approach Subsection and a small portion of the Monterey Corridor Subsection.

[4] Although 60 Hz magnetic fields are generated by the OCS, the HSR track centerline is used as a proxy from which distance to sensitive receptors and other potentially affected land uses is measured.

Local Conditions

Analysts conducted a preconstruction survey to measure EMF at 10 locations along the project extent in accordance with technical guidance developed by the Authority. The purpose of the survey was to establish EMF levels that are representative of existing conditions in the RSA. Analysts selected sites for two different purposes: (a) to obtain measurements for a range of EMF levels, including both high-EMF sites, such as those near power lines and antenna towers, and those in relatively quiet areas for comparison; and (b) to document existing EMF levels at sensitive facilities along the alignment, such as medical and high technology facilities. These measurement sites represent a cross section of typical local emitters, such as power lines and antenna towers, potentially sensitive facilities, such as medical and high-technology facilities, and areas that are relatively free of EMF point sources. Appendix 3.5-A documents the process for conducting field survey measurements, describes measurement sites, and discusses the existing EMF levels in the project vicinity.

Sensitive Receptors

Sensitive receptors consist of land uses and facilities susceptible to EMFs and EMI produced by the HSR. These receptors include: railroads and rail transit systems, airports, residential dwellings, schools, preschools and daycare facilities, public parks, hospitals, commercial and industrial facilities, and agricultural operations (farms). Their sensitivity is due to the potential exposure of people and farm animals (e.g., livestock, poultry) to EMFs or because communications systems, sensitive equipment, or other electronic devices are present that could be disrupted by EMFs. Analysts conducted a visual assessment of sensitive land uses as part of field surveys measuring the existing electromagnetic environment (see Appendix 3.5-A for additional information).

EMF and EMI Levels

Analysts performed the following steps to predict EMF levels from HSR operations:

- Identified EMF-sensitive land uses through a review of aerial imagery, field visits, county parcel data, and local planning documents.
- Measured baseline EMF levels in the field, as described in Appendix 3.5-A.
- Calculated the anticipated maximum 60 Hz magnetic fields that a single HSR train would produce using the Magnetic Field Calculation Model, a mathematical model of the HSR traction electrical system.
- Modeled the anticipated EMF levels at a given sensitive receptor as a result of operations of the electrical infrastructure and network upgrade components using typical levels generated by transmission and power lines at various distances (shown in Table 3.5-3).

The Magnetic Field Calculation Model incorporates conservative assumptions for potential HSR EMF impacts from train operations. They represent worst-case conditions by assuming a maximum train current of 930 amperes. Typical operating currents would be approximately 20 percent less. In addition, the projected maximum magnetic fields would exist only for a short period and only in certain locations as the train moves along the track or changes its speed and acceleration. The magnetic field levels would decline rapidly as the lateral distance from the track centerline increases. These characteristics would be the same for both aboveground and belowground (tunnel) portions of the HSR alignments. For most locations and most times, exposure to EMFs would not be as high as predicted by the Magnetic Field Calculation Model, which predicts peak EMF levels.

The Magnetic Field Calculation Model also identifies how the projected maximum EMF levels would vary with the radial distance from the centerline of the HSR tracks (used as a proxy for the distance to the source of EMF, the OCS). For the sensitive land uses identified, the maximum EMF levels that would be emitted by the HSR system were predicted and compared to the measured, existing ambient conditions. Because magnetic fields would be expected to be the

dominant EMF impact from the HSR operations,[5] these results formed the basis of the EMF impact analysis.

Analysts predicted EMF levels on sensitive receptors associated with the new or modified components of the electrical infrastructure and network upgrades based upon typical EMF levels anticipated to be generated by transmission and power lines at specific distances from the source, as shown in Table 3.5-3. EMFs would also be produced within electric substations, but due to the spacing of electrical equipment, measured field strengths would be low outside the fence lines of the substations. Fields close to substations would be primarily produced by the entering power lines (Western Area Power Administration n.d.).

EMF impacts on sensitive land uses were identified based upon the differences between predicted EMF levels and existing conditions. The data from the 10 site measurement locations were generalized to represent the entire RSA. Where the predicted EMFs generated by the operations of the HSR system and electrical infrastructure and network upgrades would be higher than typical existing levels for exposure, the potential for EMI was used to evaluate the magnitude of potential effects.

3.5.4.4 Method for Evaluating Impacts under NEPA

The CEQ NEPA regulations (40 C.F.R. Parts 1500–1508) provide the basis for evaluating project effects (as described in Section 3.1.6.4). As described in Section 1508.27 of these regulations, the criteria of context and intensity are considered together when determining the severity of the change introduced by the project.

- **Context**—For the analysis of EMF and EMI effects, the context would include the existing levels of EMF within the RSA; the location and type of sensitive receptors and land uses along the project corridor, including proximity to sensitive equipment, adjacent railroads, electrical transmission facilities, or railroad towers; and the regulatory setting pertaining to EMF and EMI, including guidelines developed for EMF exposure.
- **Intensity—**For the analysis of EMF and EMI effects, the intensity or severity of an effect would assess the magnitude of the change between the existing and modeled EMF levels; the degree to which the proposed project could affect public health by exposing people to EMF health risks in exceedance of applicable standards, exposing people to electric shock, or interfering with implanted biomedical devices; and the degree to which the proposed project could affect public safety by interfering with the operation of nearby railroads, rail transit systems, airports, or other businesses.

To inform the severity of an effect, projected levels of EMFs and EMI were compared to No Project levels. Analysts determined whether the increase would be of sufficient magnitude, frequency, or duration to present a documented health risk to persons living or residing in the project area and whether the increase could interfere with existing operations of an electrical device.

3.5.4.5 Method for Determining Significance under CEQA

CEQA requires an EIR to identify the significant environmental impacts of a project (CEQA Guidelines Section 15126). One of the primary differences between NEPA and CEQA is that CEQA requires a threshold-based impact analysis. Significant impacts are determined by evaluating whether project impacts would exceed the significance threshold established for the resource (Section 3.1.6.4). The Authority is using the following thresholds to determine if a CEQA significant impact from EMF or EMI would occur as a result of the project alternatives. The significance thresholds are based upon relevant research and documentation on potential EMF and EMI safety levels, such as the ANSI/IEEE, FCC, and OSHA safety levels presented in Section 3.5.2. For the CEQA analysis, the project would result in a significant impact from EMFs and EMI if it would:

[5] The HSR OCS and distribution systems would primarily have 60 Hz magnetic fields, which are significantly lower than the frequency levels presented in Table 3.5-6.

- Expose a person to a documented EMF health risk, including a field intensity over the limit of an applicable standard, an electric shock, or interference with an implanted biomedical device
- Disrupt agricultural activities near the HSR
- Interfere with nearby sensitive equipment, including equipment at hospitals, industrial and commercial facilities, railroads, rail transit systems, or airports

Quantitative EMF and EMI thresholds for determining CEQA significance for human exposure and interference are defined as follows:

- **Human Exposure**—The MPE limit (IEEE 2002) (Table 3.5-4) for 60 Hz magnetic fields for the instantaneous exposure of the general public is 9.04 G (9,040 mG or 904 µT); the MPE for controlled environments where only employees are present is 27.12 G (27,120 mG or 2,712 µT). The MPE limit (IEEE Standard C95.6) (Table 3.5-5) for 60 Hz electric fields for the general public is 5,000 V/m (5 kV/m). The MPE is 20,000 V/m (20 kV/m) for controlled environments in which only HSR employees would work. Additionally, MPE limits for employees with pacemakers are lower, with a maximum of 1 G (1,000 mG or 100 µT) for exposure to magnetic fields and 1,000 V/m (1 kV/m) for exposure to electric fields. Table 3.5-7 summarizes these numerical limits. Note that these levels are not-to-exceed values, with no allowance for exposure duration. The IEEE Standard C95.6 was formally adopted by the American National Standards Institute and is used regularly throughout the United States to analyze potential impacts related to EMF. The safety levels established by this standard are well below the levels at which scientific research has shown harmful effects may occur, thus incorporating a large safety factor (IEEE 2006). The HSR electrification and traction systems would mainly generate 60 Hz EMFs, which this standard addresses (IEEE 2002).
- **Interference**—The threshold for determining CEQA significance from EMI is a shift of 2 mG in the background magnetic field. This threshold is also a screening level for potential disturbance to unshielded sensitive equipment as identified in the Footprint Report (Authority 2012).

Table 3.5-7 Maximum Permissible Exposure Levels to Determine CEQA Significance

Sensitive Receptor Type	Frequency Range (Hz)	Exposure Limit for Magnetic Fields (mG)	Exposure Limit for Electric Fields (V/m)
General Public	60	9,040	5,000
HSR Employees	60	27,120	20,000
HSR Employees with pacemakers	60	1,000	1,000

Source: IEEE 2002; ACGIH 2015
Hz = hertz
mG = milligauss
V/m = volts per meter

3.5.5 Affected Environment

This section describes the affected environment related to EMFs and EMI in the RSA, including sources of EMFs and EMI, local conditions, and receptors susceptible to EMF or EMI impacts along the project footprint for each alternative. This information provides the context for the environmental analysis and evaluation of impacts.

3.5.5.1 Regional and Local Sources of EMFs and EMI

Electromagnetic emissions are generated by a variety of localized, as well as pervasive, wide-scale regional sources. Pervasive sources (e.g., television, radio) are present over large areas extending tens to hundreds of miles from the broadcast antennas and are captured in measurements taken at the various measurement sites. Localized sources are typically substantial only within a few miles of the transmitting antenna, with observed levels above background just at the measurement site nearest the source. Localized RF sources could include

law enforcement, fire, and other emergency communications, and commercial and civilian transmissions, including amateur radio. Electromagnetic emissions are further characterized by temporal variations, as many EMF emitters operate only occasionally.

The measured regional sources along the project extent include strong telecommunication transmitters that broadcast over large areas, radars and navigational aids, and electrical substations. These sources include AM and FM radio stations, land mobile radio transmitters, air-to-ground transceivers, cellular telephone antennas, microwave communication links, and television station transmissions. The project alternatives would also pass within 1,600 feet of the Norman Y. Mineta San Jose International Airport and within 1,400 feet of San Martin Airport, both of which have a large number of RF sources and sensitive receptors. Analysts photographed the sources that were visually identified as near or in the line-of-sight of the measurement locations (see Appendix 3.5-A). Photographs taken at measurement locations along the project extent show the presence of many sources, including police and fire department and FM radio transmitters.

3.5.5.2 Local Conditions

The project extent includes urban and rural areas from San Jose to Carlucci Road, the eastern boundary of the project extent studied in detail in this document. Adjacent land uses are predominantly commercial, industrial, and residential in the urban northern portion of the project extent. East of Gilroy, to the San Joaquin Valley, the land use is rural and consists of agriculture, open space, residential, and some commercial (refer to Section 3.13 for a more detailed discussion of existing land uses). Urban and rural settings have different sensitivities associated with EMFs and EMI:

- Urban areas include more densely spaced residential housing, high-voltage overhead power lines, and associated urban infrastructure. These areas may include laboratories and other facilities that operate EMI-sensitive research or medical devices.
- Rural areas typically have only a few residences, which are sparsely distributed. These areas may have underground pipelines, underground cables, and fencing associated with agricultural operations, including irrigation systems that may be affected by EMFs and EMI.

Analysts determined existing local conditions by measuring EMF levels at representative locations selected through a review of land uses, existing facilities, and infrastructure within the RSA. This review concentrated on identifying potentially EMI-sensitive facilities, as well as existing EMF sources, such as power distribution and communications facilities. An initial list of approximately 30 candidate sites was identified for further evaluation. The evaluation criteria, taken from TM 3.4.11, Measurement Procedure for Assessment of CHSTP Alignment EMI Footprint (Authority 2010a), favored providing a balanced coverage of:

- The geographic extent of the segment
- High-emission sites
- Low-emission sites
- Sites with high-sensitivity receptors

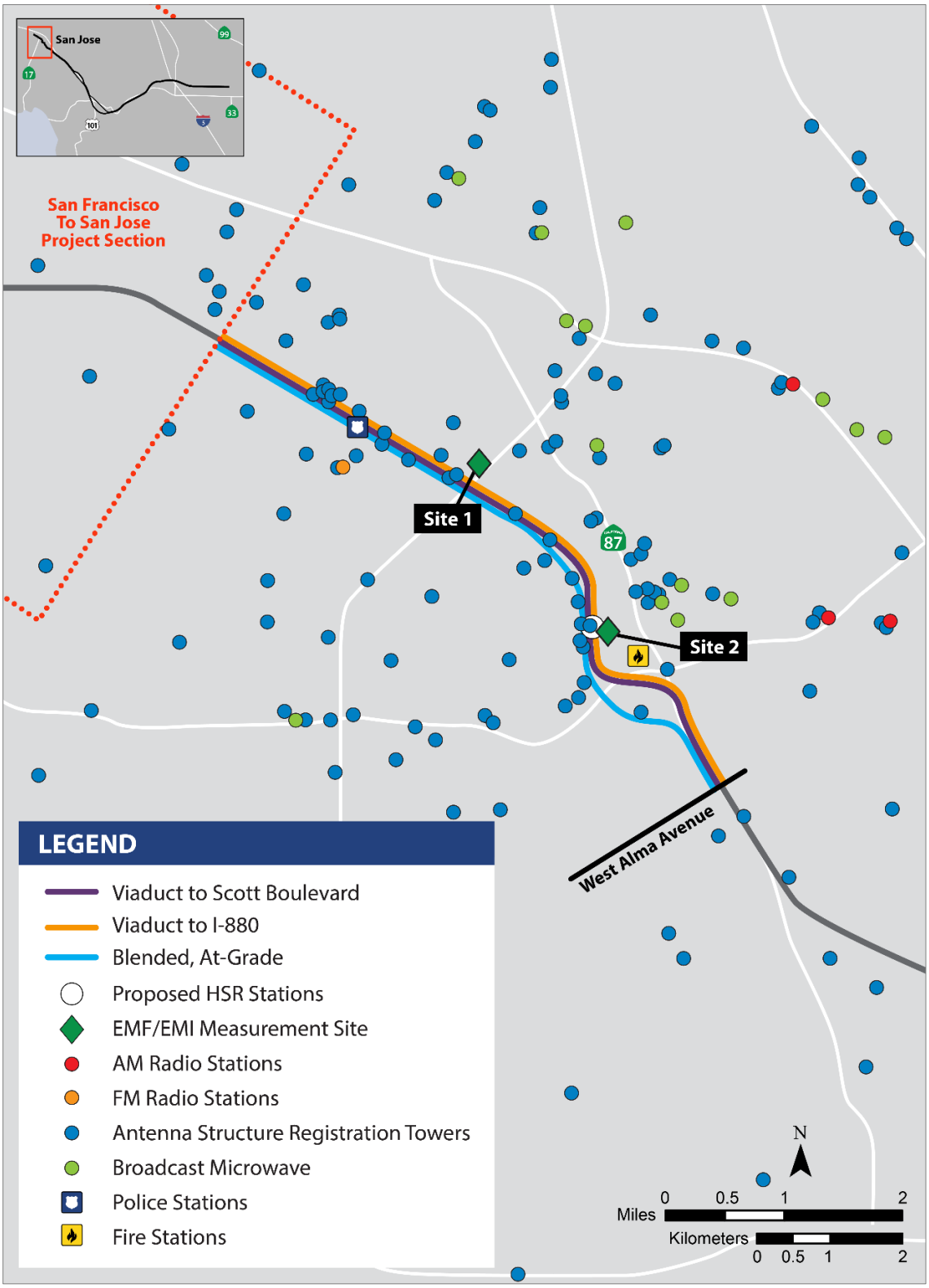
Analysts selected 10 measurement sites based upon these considerations. These measurement locations are identified in Table 3.5-8 and shown graphically in Figure 3.5-1 through Figure 3.5-5.

Table 3.5-8 EMI Measurement Locations

Site	Community	Location	Geographic Coordinates	Notable EMF Sources or Sensitive Receptors
San Jose Diridon Station Approach Subsection				
1	San Jose	Newhall Street / Newhall Drive	37.347447°, (121.923012°)	Adjacent to Avaya Stadium; nearby cell towers; San Jose International Airport communications and aviation RF sources.

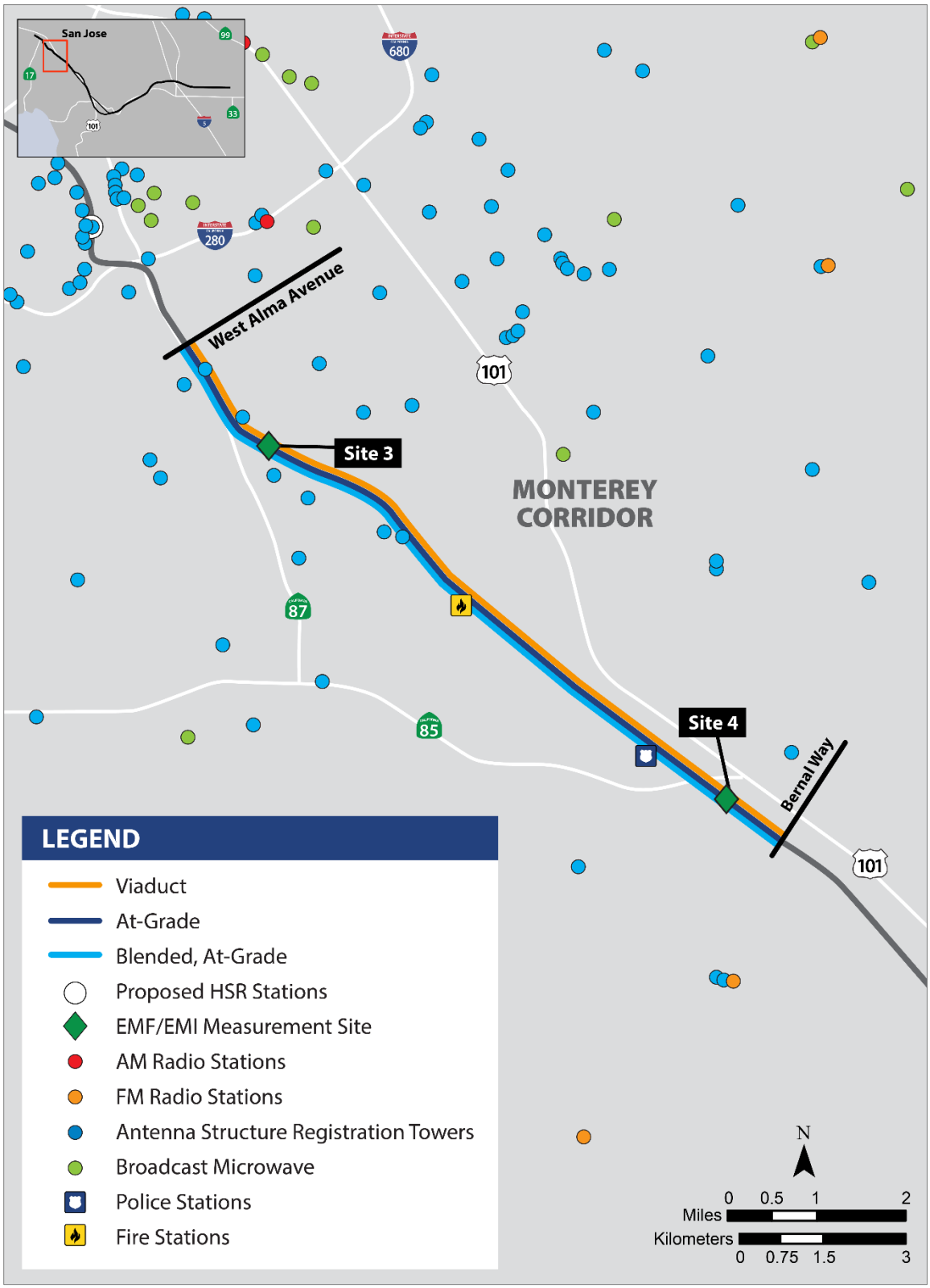
Site	Community	Location	Geographic Coordinates	Notable EMF Sources or Sensitive Receptors
2	San Jose	Montgomery Street / Otterson Street	37.328142°, (121.902140°)	Adjacent to the Diridon Caltrain station and PG&E substation.
Monterey Corridor Subsection				
3	San Jose	Communication Hill / Curtner Avenue	37.293722°, (121.865194°)	Mostly residential area, but with significant RF sources nearby, including Santa Clara Sheriff, County Fire Station, and cellular communications. Adjacent to existing ROW.
4	San Jose	Great Oaks Parkway / Las Colinas Road	37.239322°, (121.776080°)	High-technology office park with potentially sensitive receptors, including nearby MRI operators. Adjacent to existing ROW. Suburban/commercial environment.
Morgan Hill and Gilroy Subsection				
5	Coyote	Metcalf Road / Coyote Ranch Road	37.223022°, (121.744592°)	Industrial location between Metcalf power plant (600 MW) and PG&E substation. Adjacent to existing ROW.
6	Morgan Hill	Railroad Avenue / Barrett Avenue	37.118225°, (121.638550°)	Adjacent to existing ROW, across street from the Morgan Hill Police Station. Numerous suburban RF sources.
7	Gilroy	Monterey Highway / Las Animas Avenue	37.028851°, (121.578510°)	Suburban/commercial area in Gilroy with limited local RF sources, adjacent to existing ROW. Magnetic field transients due to existing rail traffic.
8	Hollister	SR 152/ south of Casa de Fruta	36.985247°, (121.383899°)	Along SR 152, 10 miles east of Gilroy. No visible RF sources.
Pacheco Pass Subsection				
9	Santa Nella	Santa Nella Avenue / Fahey Road	37.126085°, (121.015302°)	Quiet site: Agricultural area north of Santa Nella. No local RF emitters. Distribution lines only.
San Joaquin Valley Subsection				
10	Dos Palos	Henry Miller Road / Carlucci Road	37.097787°, (120.680892°)	Quiet site: Agricultural area. Nearest significant RF emitters in Los Banos (8 miles). Distribution lines only.

(Parentheses) indicate negative values.
EMF = electromagnetic fields
EMI = electromagnetic interference
PG&E = Pacific Gas and Electric Company
MW = megawatt
MRI = magnetic resonance imaging
RF = radio frequency
ROW = right-of-way
SR = State Route



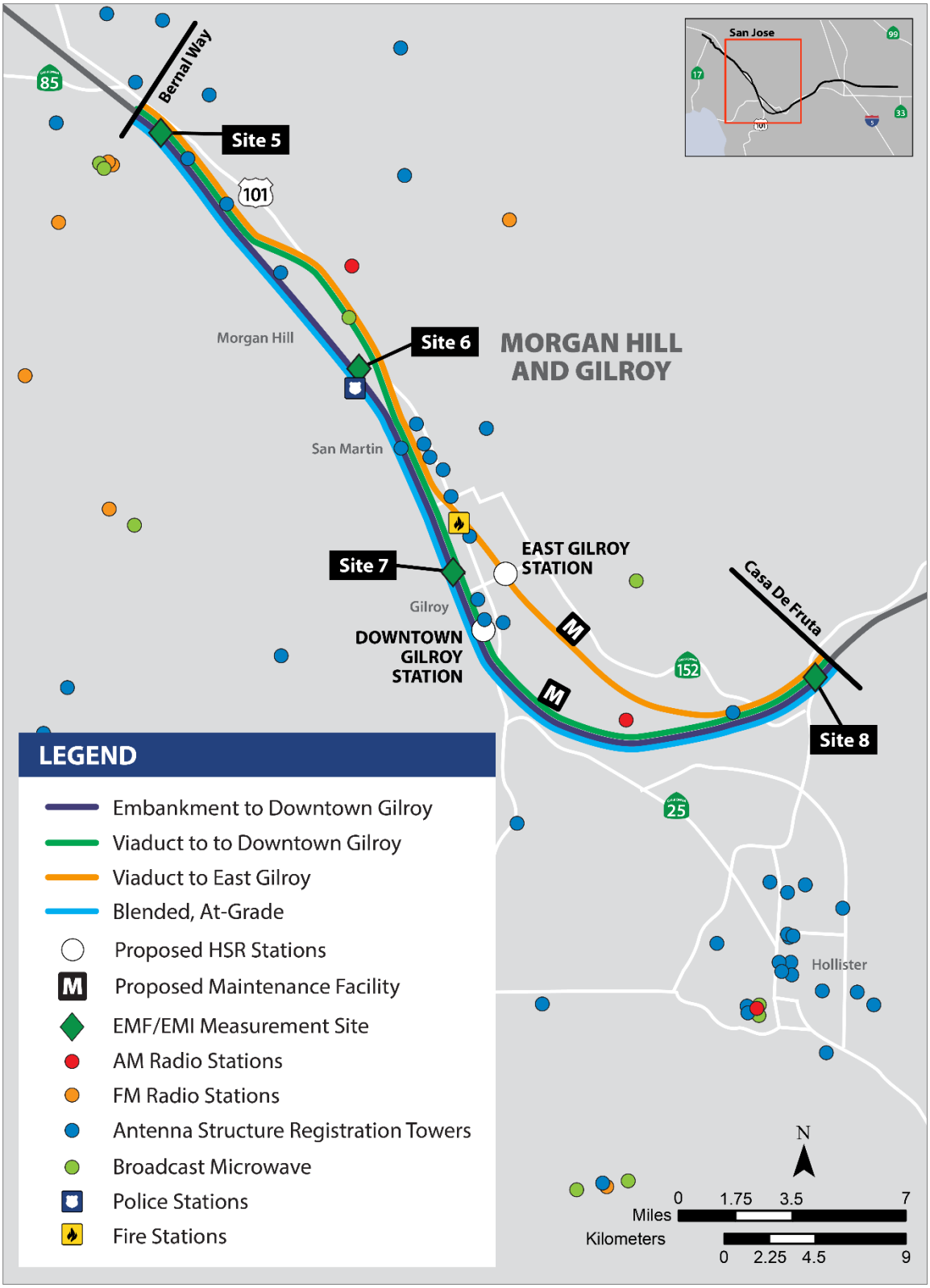
JANUARY 2018

Figure 3.5-1 EMF Measurement Site Locations with Existing Sources of EMF and EMI: San Jose Diridon Station Approach Subsection



JANUARY 2018

Figure 3.5-2 EMF Measurement Site Locations with Existing Sources of EMF and EMI: Monterey Corridor Subsection



JANUARY 2018

Figure 3.5-3 EMF Measurement Site Locations with Existing Sources of EMF and EMI: Morgan Hill and Gilroy Subsection

JANUARY 2018

Figure 3.5-4 EMF Measurement Site Locations with Existing Sources of EMF and EMI: Pacheco Pass Subsection

Figure 3.5-5 EMF Measurement Site Locations with Existing Sources of EMF and EMI: San Joaquin Valley Subsection

Analysts conducting the field survey measured RF levels from 10 kHz to 6 GHz, which encompasses many different applications, including broadcast radio and digital television signals, fixed and mobile communications, cellular telephones, and radar and navigation systems. In general, analysts observed the highest RF levels in San Jose and other urban areas. The survey also quantified typical power-frequency magnetic field levels along the project extent to characterize typical DC and ELF (up to 1,000-Hz) sources, such as high-voltage transmission lines, electrical distribution lines, and electrical substations or generating equipment. The maximum or peak 60-Hz magnetic fields recorded in this survey varied widely from approximately 0.01 mG to approximately 47 mG, depending primarily upon the measurement locations' proximity to local distribution and transmission power lines (Table 3.5-8). The field survey measurement results are discussed in detail in Appendix 3.5-A.

Table 3.5-9 summarizes the distance of the measurement site from the centerline of the nearest HSR track, the measured electric field and AC (60-Hz) magnetic field strengths, and the modeled maximum HSR electromagnetic field strengths at each of the measurement sites. The variation in AC magnetic field strengths fall within expected limits for the urban and rural environments of the project extent. The modeled HSR AC field strengths at the same locations are typically 10 to 100 times greater than the background level, with the actual field strength depending on the HSR track centerline-to-site distance.

Table 3.5-9 Measured and Modeled 60 Hz Magnetic Field Strengths

Site / Community	Distance from Centerline of Nearest HSR Track (feet)	Measured Electric Field Strength[1] (V/m)	Measured Electric Field Strength[1] (mW/cm2)	Measured 60 Hz Magnetic Field (mG)	Modeled 60 Hz Magnetic Field Single Train (mG)
San Jose Diridon Station Approach Subsection					
1 – San Jose	245 (Alternatives 1, 4) 170 (Alternatives 2, 3)	14.9	0.059	5.12	2.3 4.1
2 – San Jose	235 (Alternatives 1, 2, 3) 260 (Alternative 4)	21.5	0.123	16.8	2.3 1.8
Monterey Corridor Subsection					
3 – San Jose	115 (Alternatives 1, 2, 3) 100 (Alternative 4)	18.5	0.091	0.02	9.7 12.9
4 – San Jose	100 (Alternative 2) 130 (Alternatives 1, 3) 35 (Alternative 4)	5.8	0.009	0.69	12.9 7.6 109
Morgan Hill and Gilroy Subsection					
5 – Coyote	450 (Alternatives 1, 3) 530 (Alternative 2) 610 (Alternative 4)	54.7	0.795	47.20	0.6 0.4 0.3
6 – Morgan Hill	8 (Alternative 2)[2,3] 75 (Alternative 4)	5.7	0.009	0.52	177[3] 23.1
7 – Gilroy	140 (Alternatives 1, 2)[4] 235 (Alternative 4)	13.3	0.047	0.14	6.5 2.3
8 – Hollister	420 (Alternatives 1, 2, 4) 455 (Alternative 3)	6.4	0.011	0.01	0.7 0.6

Site / Community	Distance from Centerline of Nearest HSR Track (feet)	Measured Electric Field Strength[1] (V/m)	Measured Electric Field Strength[1] (mW/cm2)	Measured 60 Hz Magnetic Field (mG)	Modeled 60 Hz Magnetic Field Single Train (mG)
Pacheco Pass Subsection					
9 – Santa Nella	125 (All Alternatives)	11.4	0.034	1.61	82.8[5]
San Joaquin Valley Subsection					
10 – Dos Palos	55 (All Alternatives)	26.3	0.183	0.11	44.4

[1] Maximum observed electric field strength in any frequency band.
[2] Site 6 is located approximately 3,200 feet from Alternatives 1 and 3 and is therefore outside the resource study area for these alternatives.
[3] Site 6 is located approximately 8 feet from the HSR track centerline for Alternative 2, and, in the event that Alternative 2 is constructed, the current use at that location would be replaced with HSR infrastructure. The modeled 60 Hz magnetic field strength shown is at 22 feet (the minimum distance from the HSR track centerline to the fence line at the edge of the right-of-way) and would represent the next nearest land use.
[4] Site 7 is located approximately 4,700 feet from Alternative 3 and is therefore outside the resource study area for this alternative.
[5] Site 9 is located on the HSR track centerline for all alternatives, and, in the event that any of the alternatives is constructed, the current use at that location would be replaced with HSR infrastructure. The modeled 60 Hz magnetic field strength shown is at 22 feet (the minimum distance from the HSR track centerline to the fence line at the edge of the right-of-way) and would represent the next nearest land use.
Hz = Hertz
mG = milligauss
mW/cm2 = milliwatts per square centimeter
V/m = volts per meter

As noted in Section 3.5.4.3, Methods for Impact Analysis, the baseline EMF conditions assume the electrification of Caltrain service from Scott Boulevard in Santa Clara to Tamien Station in San Jose. Along this portion of the RSA, the electrification and upgrades would increase the EMFs generated near the tracks above the measured levels identified in Table 3.5-9. Sources of EMFs associated with the PCEP include the traction power distribution system (including traction power substations, paralleling stations, and a switching station), the OCS system, and train motors on the electrical multiple units. Table 3.5-10 summarizes the calculated field strengths for the electrified Caltrain service at several general locations: aboard passenger cars, at rail overpasses, within and outside of the Caltrain right-of-way, and proximate to traction power substations.

Table 3.5-10 Estimated EMF Field Strength for Caltrain Operations (frequency of 60 Hz)

Location	Electric Field (kV/m)	Magnetic Field (mG)	
		Average/Off-Peak	Maximum
Passenger Coach	0.0015–0.002	52	305
Overpass	N/A	11.6–15.1	29.3
Outside Right-of-Way[1]	0.35	1.9–4.5	11.4
Within Right-of-Way[2]	0.48	4–11	35–41
Traction Power Substation	0.136 (average) 0.744 (maximum)	15	110

Source: PCJPB 2015
[1] Estimates for a location 58 feet from the track centerline.
[2] Estimates for a location approximately 15 feet from the track centerline.
EMF = electromagnetic fields
Hz = hertz
kV/m = kilovolt per meter
mG = milligauss
N/A = not applicable

3.5.5.3 Sensitive Receptors and Facilities

Table 3.5-11 shows 62 discrete receptors and facilities within the RSA potentially affected by HSR system construction and operation. The table includes the receptor/facility type, location, project alternatives potentially affecting the receptor/facility, proximity of the receptor/facility to the HSR track and project footprint, and the modeled maximum HSR field strengths for a single train at each receptor/facility location. These receptors/facilities were identified based upon their proximity to the HSR alignment or associated infrastructure, such as substations or maintenance areas, proximity to HSR construction activities, or both. Similarly, Table 3.5-12 identifies four discrete facilities within the RSA in relationship to electrical infrastructure and network upgrades, along with projected electric and magnetic field strengths at each location.

In addition to the project infrastructure, existing rail systems, buried pipelines, ungrounded metallic fencing, and other linear receptors of concern are known to occur in the RSA and have potential EMI concerns.

Table 3.5-11 Sensitive Receptors and Facilities Potentially Affected by HSR System Construction and Operations

Site ID	Facility	Location	Alternative	Distance to Centerline of Nearest HSR Track (feet)	Distance to Construction Easement, (feet)	Modeled 60 Hz Magnetic Field – Single Train (mG)
San Jose Diridon Station Approach Subsection						
1	Reed Street Dog Park	888 Reed Street, Santa Clara	2, 3 1, 4	75 65	Adjacent	24.1 32.2
2	Larry J. Marsalli Park	1425 Lafayette Street, Santa Clara	2, 3 1, 4	410 340	Adjacent	0.77 1.1
3	Santa Clara Police Department	601 El Camino Real, Santa Clara	2, 3 1, 4	80 155	Adjacent	20.3 5.3
4	San Jose International Airport[1]	1701 Airport Boulevard, San Jose	2, 3 1, 4	1,630 1,710	1,510	0.05 0.05
5	Newhall Park	972 Newhall Street, San Jose	2, 3 1, 4	250 320	190	2.0 1.2
6	Bellarmine College Preparatory	960 West Hedding Street, San Jose	1, 2, 3 4	200 100	Adjacent	3.2 12.9
7	College Park	Elm Street and Hedding Street, San Jose	2, 3 1 4	710 650 625	Adjacent	0.24 0.29 0.31
8	Guadalupe River Trail, Reach 6	Woz Way to Virginia Street, San Jose	1, 2, 3 4	Adjacent 740	Adjacent	148 0.22
9	Theodore Lenzen Park	Stockton Avenue and Lenzen Street, San Jose	1, 2, 3 4	960 480	300	0.13 0.53
10	Cahill Park	West San Fernando Street & Wilson Avenue, San Jose	1, 2, 3 4	360 335	190	0.96 1.1

Site ID	Facility	Location	Alternative	Distance to Centerline of Nearest HSR Track (feet)	Distance to Construction Easement, (feet)	Modeled 60 Hz Magnetic Field – Single Train (mG)
11	San Jose Fire Department Station 30	454 Auzerais Avenue, San Jose	1, 2, 3 4	640 2,000	160	0.30 0.03
12	Los Gatos Creek Trail	East Main Street at College Avenue, San Jose	1, 2, 3, 4	Adjacent	Adjacent	148
13	Gardner Elementary School	502 Illinois Avenue, San Jose	1, 2, 3 4	225 850	60	2.5 0.17
14	Biebrach Park	Delmas Street and Virginia Street, San Jose	1, 2, 3 4	1,080 390	910	0.10 0.81
15	Fuller Park	Fuller Avenue & Park Avenue, San Jose	1, 2, 3 4	500 Adjacent	440	0.46 148
16	Tamien Child Care Center	1197 Lick Avenue, San Jose	1, 2, 3 4	270 215	120	1.7 2.7
17	Class I Bikeway	Willow Street to Curtner Avenue, San Jose	1, 2, 3, 4	Adjacent	Adjacent	148
18	Highway 87 Bikeway	Along Highway 87, San Jose	1, 2, 3, 4	Adjacent	Adjacent	148
19	Jesse Frey Community Garden	West Alma Avenue and Belmont Way, San Jose	1, 2, 3 4	770 805	375	0.20 0.19
20	Three Creeks Trail	Highway 87 to Senter Road, San Jose	1, 2, 3, 4	Adjacent	Adjacent	148
Monterey Corridor Subsection						
21	Communications Hill Trail	Grassina Street to Communications Hill Boulevard, San Jose	1, 2, 3, 4	150	Adjacent	5.7
22	San Jose Fire Department Station 18	4430 Monterey Highway, San Jose	1, 3 2 4	100 150 220	Adjacent	12.9 5.7 2.6
23	Edenvale Gardens Regional Park	200 Edenvale Avenue, San Jose	1, 3 2 4	185 130 60	35	3.7 7.6 36.4
24	San Jose Police Department South Station	6087 Great Oaks Parkway, San Jose	1, 3 2 4	280 235 175	165	1.6 2.3 4.1

Site ID	Facility	Location	Alternative	Distance to Centerline of Nearest HSR Track (feet)	Distance to Construction Easement, (feet)	Modeled 60 Hz Magnetic Field – Single Train (mG)
Morgan Hill and Gilroy Subsection						
25	Great Oaks Research Park	23 Las Colinas Lane, San Jose	1, 3 2 4	285 255 185	55	1.5 1.9 3.7
26	Metcalf Park	Forsum Road, San Jose	1, 3 2 4	425 450 520	340	0.68 0.61 0.45
27	Fisher Creek Trail	Monterey Highway to Santa Teresa Boulevard, San Jose	1, 2, 3, 4	Adjacent	Adjacent	148
28	Coyote Creek Parkway	Coyote Ranch Road, San Jose	1, 2, 3, 4	Adjacent	Adjacent	148
29	Coyote Creek Trail	Hellyer Avenue to Metcalf Road, San Jose	1, 3 2 4	30 100 140	Adjacent	148 12.9 6.5
30	Charter School of Morgan Hill	9530 Monterey Road, Morgan Hill	1, 3 2 4	110 135 40	Adjacent	10.6 7.0 82.8
31	Central High School (annex)	85 Tilton Avenue, Morgan Hill	2 4	325 250	260	1.2 2.0
32	Paramit Manufacturing	18735 Madrone Parkway, Morgan Hill	2 4	230 340	70	2.2 1.1
33	Sanchez Park	Sanchez Drive, Morgan Hill	2 4	360 260	180	0.96 1.8
34	Butterfield Professional Center	295-345 Digital Drive, Morgan Hill	2 4	60 140	Adjacent	36.4 6.5
35	Shadow Mountain Baptist School	17810 Monterey Road, Morgan Hill	2 4	415 330	315	0.72 1.1
36	El Toro Elementary School	455 E Main Street, Morgan Hill	2 4	1,320 1,400	90	0.07 0.06
37	Lewis H. Britton Middle School	80 W Central Avenue, Morgan Hill	2 4	800 720	380	0.19 0.23
38	Gavilan College	17060 Monterey Road, Morgan Hill	2 4	515 440	Adjacent	0.46 0.64
39	Morgan Hill Community and Cultural Center	17000 Monterey Road, Morgan Hill	2 4	515 440	Adjacent	0.46 0.64

Site ID	Facility	Location	Alternative	Distance to Centerline of Nearest HSR Track (feet)	Distance to Construction Easement, (feet)	Modeled 60 Hz Magnetic Field – Single Train (mG)
40	Barrett Elementary School	895 Barrett Avenue, Morgan Hill	1, 3	300	260	1.4
41	Morgan Hill Police Department	16200 Vineyard Boulevard, Morgan Hill	2 4	150 65	40	5.7 30.9
42	San Martin/Gwinn Elementary School	13745 Llagas Avenue, San Martin	1, 2, 3 4	360 440	230	1.0 0.64
43	A+ Learning Center Preschool	13570 Depot Street, San Martin	1, 2, 3 4	155 235	25	5.3 2.3
44	San Martin Airport[1]	13030 Murphy Avenue, San Martin	1, 2, 3 4	1,400 1,480	700	0.06 0.06
45	Santa Clara County Fire Department, Masten Station	10810 No Name Uno, Gilroy	3	700	480	0.25
46	Rucker Elementary School	325 Santa Clara Avenue, Gilroy	3	310	240	1.3
47	Davis Poultry Farms	155 Santa Clara Avenue, Gilroy	1, 2 4	120 210	55	8.9 2.9
48	Christopher High School	850 Day Road, Gilroy	1, 2, 3, 4	3,800	60	0.01
49	St. Louise Regional Hospital	9400 No Name Uno, Gilroy	3	1,100	100	0.10
50	South Valley Middle School	385 IOOF Avenue, Gilroy	1, 2 4	545 665	Adjacent	0.41 0.28
51	Gilroy Preparatory School	277 Ioof Avenue, Gilroy	1, 2 4	Adjacent 130	Adjacent	148 148
52	Rebekah Children's Center	290 Ioof Avenue, Gilroy	1, 2 4	225 320	Adjacent	2.5 1.2
53	San Ysidro Park	7700 Murray Avenue, Gilroy	1, 2, 3 4	1,570 1,660	120	0.05
54	Wheeler Tot Lot	250 West 6th, Gilroy	1, 2 4	1,140 1,065	475	0.09 0.11
55	Forest Street Park	7325 Forest Street, Gilroy	1, 2 4	530 620	145	0.44 0.32
56	Anchorpoint Christian School	2320 Pacheco Pass Highway, Gilroy	3	630	Adjacent	0.3

Site ID	Facility	Location	Alternative	Distance to Centerline of Nearest HSR Track (feet)	Distance to Construction Easement, (feet)	Modeled 60 Hz Magnetic Field – Single Train (mG)
Pacheco Pass Subsection						
57	San Luis Reservoir Wildlife Management Area	30 miles east of Gilroy, south side of Pacheco Pass along SR 152, Merced and Santa Clara Counties	1, 2, 3, 4	Adjacent (in tunnel)	Adjacent	148
58	San Luis Reservoir State Recreation Area	On SR 152, 7 miles west of I-5, 33 miles east of Gilroy, Merced and Santa Clara Counties	1, 2, 3, 4	1,000	890	0.12
59	Cottonwood Creek Wildlife Area	36 miles east of Gilroy, northeast of SR 152, Merced and Santa Clara Counties	1, 2, 3, 4	Adjacent (in tunnel)	Adjacent (in tunnel)	148
San Joaquin Valley Subsection						
60	Los Banos Wildlife Area	4 miles northeast of Los Banos, Merced County	1, 2, 3, 4	155	60	5.3
61	Soares Dairy Farms	14155 Badger Flat, Los Banos	1, 2, 3, 4	30	Adjacent	150
62	Talbott Sheep	20654 Henry Miller Road, Los Banos	1, 2, 3, 4	170	85	4.4

[1] Although San Jose International Airport and San Martin Airport are located outside of the resource study area, they are included in this analysis as sensitive receptors given the safety-critical nature of radio-based systems and uncertainties about the locations of much of the equipment within each airport.
HSR = high-speed rail
Hz = Hertz
mG = milligauss

Table 3.5-12 Sensitive Receptors and Facilities Potentially Affected by Electrical Infrastructure and Network Upgrades

Site ID[1]	Facility	Location	Distance to Nearest Network Upgrade (feet)	Distance to Nearest Interconnection Facility (feet)	Estimated Electric Field Strength (kV/m)	Estimated Magnetic Field Strength (mG)
San Jose Diridon Station Approach Subsection						
4	San Jose International Airport	1701 Airport Boulevard, San Jose	300	N/A	0.003	0.2
Morgan Hill and Gilroy Subsection						
37	Lewis H. Britton Middle School	80 West Central Avenue, Morgan Hill	Adjacent	75	0.5	6.5
48	Christopher High School	850 Day Road, Gilroy	Adjacent	N/A	0.5	6.5
53	San Ysidro Park	7700 Murray Avenue, Gilroy	130	N/A	0.07	1.7

[1] Sensitive receptors listed in this table are also listed in Table 3.5-11.
kV/m = kilovolts per meter
mG = milligauss
N/A = not applicable

3.5.6 Environmental Consequences

3.5.6.1 Overview

This section discusses the potential impacts associated with EMF/EMI generated by the No Project Alternative and the project alternatives during project construction and operation. This section evaluates impacts of EMF/EMI on sensitive receptors and facilities including humans, livestock, sensitive equipment, schools, underground pipelines and cables, adjoining rail systems, and airport communication systems.

Project construction would generate RF fields from occasional radio transmissions and DC magnetic field disturbances from movement of large construction vehicles and equipment. These impacts would be intermittent, occurring only during construction, and would be primarily restricted to the construction areas. Operational and maintenance activities would affect local EMF and EMI levels, potentially increasing EMF exposure of sensitive receptors or causing nuisance shocks. These impacts could be either temporary, occurring intermittently during operations of the project, or permanent, occurring continuously during operations.

The Authority has incorporated IAMFs to address EMF and EMI that are described in Volume 2, Appendix 2-E. These features assure compliance with EMI/EMF standards by specifying standard design practices for electronic equipment, requiring coordination with adjacent railroad engineering departments, designing the HSR system to international guidelines, and complying with federal and state laws and regulations pertaining to EMF and EMI. Prior to the activation of any potentially interfering HSR systems, the Authority would contract with a qualified engineering professional to validate the efficacy of design provisions preventing interference.

The IAMFs differ from mitigation measures in that they are part of the project and will be implemented by the Authority as a binding commitment included in the project approval. In contrast, mitigation measures may be available to further reduce, compensate for, or offset project impacts that the analysis identifies under NEPA or concludes are significant under CEQA.

3.5.6.2 No Project Impacts

As discussed in Section 3.18, Regional Growth, the population in the project vicinity is expected to grow through 2040 (see Section 2.6.1.1, Projections Used in Planning). Development in the region to accommodate the population and employment increase would continue under the No Project Alternative, resulting in associated increases in sources of EMFs and EMI, as well as sensitive receptors. The analysis of potential impacts of the No Project Alternative considers the effects of conditions forecasted by current land use and transportation plans in the vicinity of the project extent, including planned improvements to the highway, aviation, conventional passenger rail, freight rail, and port systems through the 2040 planning horizon. Without the HSR project, the forecasted population growth would increase pressure to expand highway and airport capacities. The Authority estimates that additional highway and airport projects (up to 4,300 highway lane miles, 115 airport gates, and 4 airport runways) would be needed to achieve equivalent capacity and relieve the increased pressure (Authority 2012). Section 3.19, Cumulative Impacts, identifies planned and other reasonably foreseeable future projects anticipated to be constructed in the region to accommodate projected growth, including shopping centers, industrial parks, transportation projects, and residential developments.

Under the No Project Alternative, recent development trends would be anticipated to continue, leading to increasing levels of EMFs and more occurrences of EMI. Existing land would be converted for residential, commercial, and industrial development, as well as transportation infrastructure, to accommodate growth, increasing the use of and potential conflicts with EMFs. Use of electricity and RF communication equipment, including high-voltage transmission/power lines and directional and non-directional (cellular and broadcast) antennas that result in EMFs and EMI, could continue and would likely increase within the project extent. Population growth alone would result in additional use of electricity and RF communications, consistent with that currently found in the urban and rural environments in the RSA. In addition, the development of new schools, hospitals, police stations, and other facilities with sensitive equipment could increase the prevalence of receptors potentially sensitive to EMI.

The projected growth through 2040 would increase the use of electricity and RF communications because of increased development, greater use of electrical devices, and technological advances in wireless transmission (such as wireless data communication). As a result, generation of EMFs and EMI that might affect people, and sensitive receptors would continue to increase in the area. Planned development and transportation projects that could occur under the No Project Alternative would likely include building and equipment design features intended to address increased levels of EMF and EMI. Planned development would be required to comply with federal and state laws and regulations pertaining to EMF and EMI.

3.5.6.3 Project Impacts

Construction Impacts

Construction of the project could involve demolition of existing structures; clearing and grubbing; handling, storing, hauling, excavating, and placing fill; pile driving; and construction of aerial structures, bridges, road modifications, utility upgrades and relocations, HSR electrical systems, and railbeds. PG&E network upgrades would require extension of underground and/or overhead power transmission lines to three TPSSs that would be constructed as part of the project for all alternatives, and would include reconductoring of overhead electric utilities that may involve use of helicopters for equipment installation. Section 2.8, Construction Plan, further describes construction activities.

Impact EMF/EMI#1: Temporary Impacts from Use of Construction Equipment

Construction of the project alternatives would require use of heavy equipment, trucks, and light vehicles, which, like all motor vehicles, generate EMFs. EMFs generated by motor vehicles, however, consist of highly localized fields and would attenuate within a few feet of each vehicle (Ferrari et al. 2001). The construction equipment, communications equipment, and construction activities would be effectively the same for any of the project alternatives; only the locations of

construction activities would differ among the alternatives. Construction effort for the Diridon design variant (DDV) and tunnel design variant (TDV) would be approximately the same as the alternatives without the design variants and would occur in the same general locations, and thus DDV and TDV construction would not result in any change in the generation of EMFs during construction.

Three livestock and poultry operations and one wildlife area are within the RSA of the project alternatives (sites 47, 61, 62, and 59 in Table 3.5-11). Studies conducted in response to concerns about impacts on farm animals and wildlife documented little impact from EMFs. With regard to dairy production, McGill University conducted a study that exposed cows in pens to controlled EMF levels of 300 mG and 10 kV/m, the projected magnetic and electric fields that occur at ground level under a 735-kV line at full load. The researchers measured melatonin levels, prolactin levels, milk production, milk-fat content, dry-matter intake by cows, and reproductive outcomes. While a few statistically significant changes in these factors were found, none of the changes were outside the normal range for cows (McGill University 2006). The study concluded that the EMF exposure did not harm the cows or reduce milk productivity.

Various studies cited by other researchers regarding EMFs and wildlife suggest a range of effects similar to livestock, from nonexistent to relatively small to positive. One study, conducted at exposure levels between 50 and 100 mG, suggested a beneficial application for extremely low frequency EMFs in broiler chickens to fight a common parasitic infection called coccidiosis (Golder Associates 2009). These studies concluded that EMF exposure at levels that would exceed levels that would be generated during project construction would not harm farm animals or reduce their productivity (Golder Associates 2009). Therefore, EMFs generated by construction of any of the project alternatives would not disrupt agricultural operations because they would not affect livestock and poultry productivity.

Movement of large construction vehicles could result in transient changes to the static (DC) magnetic field. While such changes could interfere with some equipment, construction vehicles must be both very large and operate very closely to the equipment in question to cause interference. As an example, articulated buses (approximately 50,000 pounds) produce magnetic field shifts of approximately 0.5 mG at a distance of 70 feet (ERM 2007). For a construction vehicle with twice the mass of an articulated bus, the magnetic field shift would be 1 mG at 70 feet or 2 mG at 50 feet. Because the magnitude of this disturbance would decrease with distance, construction vehicles would pose no reasonable interference risk to magnetically sensitive equipment at pass-by distances greater than 50 feet because any magnetic shift at this distance would be below 2 mG. In general, all receptors that would be likely to operate sensitive equipment subject to potential interference by large construction equipment would be located more than 50 feet from construction easements (see Table 3.5-11). An exception would occur under Alternative 1, which would conduct construction within 15 feet of the Butterfield Professional Center. The design of all alternatives, including Alternative 1, will avoid interference to sensitive equipment at this facility through preconstruction review and design of features that avoid potential interference with neighboring land uses, in accordance with federal and state laws requiring avoidance of EMI (EMI/EMF-IAMF#2).

EMI during construction could be generated from occasional licensed radio transmissions between construction vehicles. As indicated in Section 3.5.1.1, Definition of Terminology, the HSR project would adhere to 47 C.F.R. Part 15 and its general provision that devices may not cause interference, must accept interference from other sources, and must prohibit the operation of devices once the operator is notified by the FCC that the device is causing interference. Adherence to these provisions would control the generation of EMI from communication equipment during construction activities. Unintended EMFs from use of construction vehicles, heavy equipment, and electric motors would be minor, and radio communications systems used on construction sites would comply with FCC regulations. Construction of the project would not be a source of EMI that could cause electric shocks; interfere with implanted medical devices; interfere with unshielded sensitive equipment; or affect the operation of nearby railroads, airports, or other businesses.

CEQA Conclusion

The impact under CEQA would be less than significant for all alternatives because EMF generated during construction would be below levels known to disrupt agricultural activities or result in a documented health risk. Shifts in the magnetic field from the movement of large construction equipment would not exceed the threshold of 2 mG for interference with sensitive equipment because, with one exception, all receptors likely to operate sensitive equipment subject to potential interference are located more than 50 feet from the construction easements, where any such magnetic shifts would be below the 2-mG threshold. The one exception, the Butterfield Professional Center, would be within 15 feet of construction under Alternative 1; however, project features would avoid potential interference at this facility and the impact on nearby sensitive facilities would be less than significant under any alternative. In addition, radio transmissions would comply with FCC regulations designed to prevent EMI, avoiding interference with equipment operated by nearby railroads, airports, schools, or other businesses. Therefore, CEQA does not require mitigation.

Operations Impacts

Operations of the project alternatives would involve the movement of electric trains, as well as the operations and maintenance of the rail, associated structures and utilities, fencing, power system, train control, and communications. All these activities could generate EMF and interfere with the operation of electrical, magnetic, or electromagnetic devices. Additionally, HSR operations could affect adjacent rail signal systems or corrode underground pipelines or cables. Section 2.6, Operations and Service Plan, more fully describes HSR operations and maintenance activities.

Impact EMF/EMI#2: Permanent Human Exposure to EMFs

HSR operations would result in permanent, but intermittent, EMF exposure to passengers (general public) on the HSR train station platforms and HSR employees working within the HSR right-of-way. The four project alternatives would use the same technology and operate at the same intensity, so overall EMF emissions would be largely similar for any of the project alternatives. The general public also would be exposed permanently to EMFs from electrical infrastructure and network upgrade facilities, and utility employees working within interconnection facilities would be exposed to EMFs during their occupation of these facilities for maintenance activities. There would be some differences between the alternatives due to differences in alignments and speeds, but as discussed below, the field levels for both levels are far below the relevant thresholds.[6]

As shown in Table 3.5-11, modeled HSR magnetic field strengths at these locations range from less than 0.1 mG to approximately 150 mG (median value 1.5 mG) and are generally higher than the ambient field strengths shown in Table 3.5-9, which fall between 0.01 mG and 50 mG (median value 0.6 mG). For the survey sites listed in Table 3.5-9, measured ambient levels were lower than the predicted HSR levels at 7 of the 10 locations, and higher than the predicted HSR levels at 3 locations. At some sites and for some alternatives, the track alignment falls partially within the site boundaries (noted as “adjacent” in Table 3.5-9). At those sites with overlap, and in the event that an alternative is constructed, the current use at that location would be replaced with HSR infrastructure. The modeled 60-Hz magnetic field strength shown in the table is at 30 feet (the minimum distance from the HSR track centerline to the fence line at the edge of the right-of-way) and would represent the next nearest land use.

Operation of the HSR system would generate 60 Hz electric and magnetic fields on and adjacent to trains, including in passenger station areas. The design of the project would substantially limit and control EMF. Table 3.5-13 presents predicted EMF levels that passengers or members of the public could be exposed to at a station platform, at the fence line, and 500 feet from the HSR track centerline. In all cases, the predicted EMF value would be less than the most restrictive

[6] Due to slightly higher speeds in the area of the DDV, HSR train operations would generate slightly higher EMFs in the DDV area for Alternative 4 with the DDV than Alternative 4 without the DDV, but still would be well below the threshold levels.

MPE limits (for HSR employees with pacemakers) of 1 kV/m for electric fields and 1,000 mG for magnetic fields. MPE limits are identified in Table 3.5-7.

Table 3.5-13 Summary of HSR Exterior EMF Levels

EMF Modeled Analysis	Platform: 16 Feet from HSR Track Centerline	Fence Line: 30 Feet from HSR Track Centerline	Resource Study Area: 500 Feet from HSR Track Centerline
Magnetic Field (mG) Single-Train HSR	720	177	Less than 1
Electric Field (V/m) Single-Train HSR	810	110	Less than 1

Source: Authority 2011a
EMF = electromagnetic field
HSR = high-speed rail
mG = milligauss
V/m = volts per meter

Due to higher speeds in the areas of the design variants, HSR train operations would generate slightly higher EMFs in the DDV and TDV areas than the alternatives without the DDV and TDV.

Passengers and HSR employees inside the HSR trains also would be exposed to EMFs. Magnetic field measurements were made in the passenger compartments on board other HSR systems, such as the Acela Express (119 mG) and the French Train à Grande Vitesse (TGV) A (165 mG), as well as in the operator's cab of the Acela Express (58 mG) and French TGV A (367 mG) (FRA 2006). Measured EMF exposure levels inside these existing HSR systems were below the most restrictive MPE limits of 1,000 mG for the HSR employees with pacemakers (IEEE 2002). The Authority will employ a 2x25 kV traction power supply system with an NF wire running above and parallel to the overhead contact system, which reduces the total magnetic field created by the supply current flowing in the OCS and the return currents flowing in the NF and rails. This arrangement would differ in some cases from those employed by the Acela Express and TGV systems and, in general, would be expected to produce magnetic fields that are lower than the quoted values on the other HSR systems that utilize a 1x25-kV system. For example, the electrified Northeast Corridor used by the Acela Express is not strictly 2x25 kV; some sections are 1x12.5 kV or 11.5 kV, and the magnetic fields in the sections without the negative return feeder would be higher than in sections with the 2x25-kV traction system arrangement (Authority 2010b). Based upon the results of magnetic field measurements at other existing HSR systems and the use of the 2x25-kV supply by the Authority for its HSR system, EMF exposure levels would be below the most restrictive MPE limits and not create a documented EMF health risk to HRS passengers and employees.

Exposure of the general public outside of the HSR system (e.g., nearby adjacent businesses, residences, hospitals, schools, parks, and other facilities) to magnetic and electric fields from HSR operations would not exceed 177 mG and 110 V/m, respectively (measured at 30 feet from the HSR track centerline as shown in Table 3.5-13). These anticipated magnetic and electric fields would be below the MPE limit for exposure of the general public to magnetic fields of 9,040 mG and to electric fields of 5,000 V/m (see Table 3.5-7). Overall, Alternatives 1 and 2 would be directly adjacent to one more sensitive receptor (receptors directly adjacent to the HSR system would be exposed to the highest levels of EMF from HSR operations) relative to Alternatives 3 and 4 (Table 3.5-11).

As shown in Table 3.5-11, four sensitive receptors (sites 4, 37, 48, and 53) are located adjacent to or near electrical infrastructure and network upgrade facilities. Scattered residences are located along the length of the Spring to Llagas and Green Valley to Llagas 115 kV power line and adjacent to Site 3–San Jose and Site 4–Gilroy. The proximity of sensitive receptors to the electrical infrastructure and network upgrades would be the same for all alternatives. Sensitive receptors along the length of the upgraded power lines and interconnection facilities would not be

exposed to a change in baseline EMF conditions because the voltage would not change, and the proximity of the electrical lines to sensitive receptors would be the same (EMF levels are a function of voltage and distance). Furthermore, the reconductoring would occur pursuant to the CPUC General Order (GO) 95 (Rules for Overhead Electric Line Construction) and GO 174 (Rules for Electric Utility Substations). Similarly, utility workers temporarily occupying interconnection facilities for maintenance activities would not be exposed to levels of EMF above baseline conditions.

CEQA Conclusion

The impact under CEQA would be less than significant for all alternatives because the EMFs generated during operations of the HSR system would fall well below the applicable MPE limits, and, therefore, the general public and HSR employees would not be exposed to a documented EMF health risk. HSR train operation EMFs would not have significant effects under CEQA even at the maximum speeds with the design variants on receptors that are located at the same distance or closer to the alignment than receptors along the DDV and TDV segments. Exposure of the general public and utility workers to EMFs from electrical infrastructure and network upgrade facilities also would not exceed baseline conditions. Therefore, CEQA does not require mitigation.

Impact EMF/EMI#3: Exposure of People with Implanted Medical Devices to EMFs

Passengers and members of the public with implanted medical devices are especially sensitive to EMFs. Magnetic fields of 1,400 to 24,000 mG (1 to 12 G) may interfere with implanted medical devices (Dawson et al. 2002; Trigano et al. 2005). The ACGIH has recommended magnetic and electric field exposure limits of 1,000 mG and 1 kV/m, respectively, for people with pacemakers (ACGIH 2015). EMF levels exceeding these limits would occur only inside traction power distribution and interconnection facilities, which are unmanned and inaccessible to the general public. Electric fields exceeding these limits may also occur directly beneath 230-kV tie-in lines; levels would fall well below this limit outside of the line right-of-way.

In addition to traction power distribution and interconnection facilities, emergency standby generators produce EMFs and would be located at passenger stations and at other traction power facilities. The emergency standby generators are also in secure work areas and inaccessible to the general public. Because the traction power distribution and emergency standby generators would only be accessible to authorized personnel, they would not present a health risk to HSR passengers, HSR workers, or other members of the public with implanted medical devices. The Implementation Stage EMC Program Plan (ISEP) (EMI/EMF-IAMF#2) will require posting signs at the TPSS, switching and paralleling stations, and on tie-line structures, warning persons with an implanted medical device of the potential for high levels of EMFs. With regard to power lines proposed to be reconductored, there would be no change in baseline conditions because the voltage and the proximity of the electrical lines to sensitive receptors would remain the same.

EMF levels above the recommended limits for employees with implanted medical devices could exist inside traction power distribution facilities, interconnection facilities, traction power switching and paralleling facilities, and the emergency standby generator rooms. These facilities and sites would be unstaffed, and workers would only enter them periodically to perform routine maintenance. In accordance with the ISEP, persons with an implanted medical device would not be permitted near these facilities and sites.

CEQA Conclusion

The impact under CEQA would be less than significant for all alternatives because the public and workers with implanted medical devices would not be exposed to an EMF health risk. Traction power distribution facilities, interconnection facilities, and emergency standby generators, which could produce EMF levels that will interfere with implanted medical devices, will be inaccessible to the general public and administratively restricted from workers with implanted medical devices per EMI/EMF-IAMF#2 and the ISEP. In addition, the ISEP and EMI/EMF-IAMF#2 prescribe that signs posted around these facilities warn persons with implanted medical devices of high levels of EMFs. Therefore, CEQA does not require mitigation.

Impact EMF/EMI#4: Livestock and Poultry Exposure

As noted in the discussion for Impact EMF/EMI#1, three livestock and poultry operations and one state wildlife area are within the RSA (Sites 47, 61, 62, and 59 in Table 3.5-11). The wildlife area and two of the agricultural operations are within the RSA for Alternatives 1 through 4, and the third agricultural operation is within the RSA for Alternatives 1, 2, and 4. However, studies conducted in response to concerns about impacts on farm animals and wildlife found that exposure to EMF levels exceeding those produced by the HSR system and associated electrical infrastructure and network upgrades would have no effect on the productivity of livestock and poultry and no effect on wildlife.

CEQA Conclusion

The impact under CEQA would be less than significant under any of the alternatives because several studies documented that EMFs do not reduce livestock or poultry productivity and would therefore not disrupt nearby agricultural activities. The three livestock and poultry operations in the RSA would be unaffected by operation of HSR trains. There would be no effect on wildlife. Therefore, CEQA does not require mitigation.

Impact EMF/EMI#5: Interference with Sensitive Equipment

Medical and high-technology facilities commonly contain equipment that could be affected by EMI, including equipment sensitive to small variations in the surrounding magnetic field (e.g., medical MRI scanners, NMR spectrometers) and focused-beam devices (e.g., electron microscopes, ion-writing systems). As described in the Footprint Report, a shift in the magnetic field of 2 mG or greater is the screening level for assessing potential effects on this type of sensitive equipment (Authority 2012). Other forms of equipment sensitive to EMFs include those susceptible to RF interference, such as fire and police radio services. Effects on school radio systems are discussed under Impact EMF/EMI#6, EMI Effects on Schools.

Within the RSA, a medical facility, St. Louise Regional Hospital (Site 49 in Table 3.5-11), and three high-technology facilities, Great Oaks Research Park, Paramit Manufacturing, and Butterfield Professional Center (Sites 25, 32, and 34 in Table 3.5-11), operate magnetically sensitive imaging equipment (MRI or CT scanners) and other potentially sensitive instrumentation. Alternative 4 could expose the Great Oaks Research Park to magnetic shifts exceeding 2 mG. Alternative 2 could expose Paramit Manufacturing to a magnetic shift exceeding 2.2 mG, potentially affecting sensitive equipment at this location. Alternatives 2 and 4 would result in magnetic field shifts of 36 mG and 6.5 mG, respectively, at the Butterfield Professional Center. Six police and fire department facilities in the cities of Santa Clara, San Jose, and Morgan Hill, and Santa Clara County (Sites 3, 11, 22, 24, 41, and 45 in Table 3.5-11) operate radio systems that may be sensitive to RF interference. The six identified facilities susceptible to EMI are located within the Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections. Four sites would be located in the Alternative 1 RSA, five sites in the Alternative 2 RSA, five sites in the Alternative 3 RSA, and four sites in the Alternative 4 RSA.

RF interference from HSR radio systems used for enhanced automatic train control, data transfer, and communications will be avoided through design characteristics and project features (IAMFs). The Authority would require that communications equipment procured for HSR use, including commercial and non-commercial off-the-shelf products, comply with FCC regulations designed to prevent EMI with other equipment or hazards to persons. The HSR project design also will comply with TM 300.10, CHSTP Implementation Stage EMC Program Plan (ISEP), which provides detailed electromagnetic compatibility design criteria for the HSR systems and equipment (EMI/EMF-IAMF#2). As part of the ISEP, the Authority would confirm compatibility of the HSR with other users' radio systems, such as those of police and fire departments, and thus avoid potential RF interference. In addition, the Authority has acquired two dedicated frequency blocks, one block each for northern and southern California, each with a width of 4 MHz, for use by automatic train control systems. These blocks are in the 700 MHz spectrum and dedicated for HSR use, and therefore are not subject to interference from or with other users. Communications systems at stations may operate at WiFi frequencies to connect to stationary trains; channels

would be selected to avoid EMI with other users (Authority 2011b, Authority 2014a, Authority 2016).

The potential for interference with sensitive equipment in use at medical facilities and high-technology facilities would be addressed through the Authority's Electromagnetic Compatibility Program Plan (EMCPP) and the design criteria of the project. The EMCPP defines the HSR system's EMC objective, which provides a performance standard of ensuring compatibility with equipment of all neighboring facilities. In conformance with the EMCPP and ISEP (TM 300.10), the Authority and its contractors will coordinate with third-party owners of sensitive facilities and equipment in the vicinity of the HSR system and, if necessary, take specific steps to avoid any potential interference (EMI/EMF-IAMF#2). Chapters 22 and 26 of the *California High-Speed Rail Design Criteria Manual* describe the EMI-related features that could be used to minimize impacts on sensitive equipment, such as equipment siting and grounding of equipment (Authority 2014b). The Authority would also conduct tests prior to operation of the HSR system to confirm sensitive equipment would not be affected. These project features would minimize the potential for interference with sensitive equipment at medical buildings and high-technology facilities.

CEQA Conclusion

The impact under CEQA would be less than significant for all alternatives because communications equipment procured for HSR use would comply with FCC regulations designed to prevent EMI interference with sensitive equipment or persons. The HSR project design also would comply with TM 300.10, which provides detailed electromagnetic compatibility design criteria for the HSR systems and equipment with other equipment. The Authority will coordinate with third parties to identify nearby sensitive equipment with the potential to be affected by the HSR system and, if necessary, take specific steps to avoid these effects and ascertain compatibility, including performing tests to confirm equipment is free from impacts (EMI/EMF-IAMF#2). RF interference would be avoided because the project would include use of dedicated frequency blocks and procurement of communications equipment meeting FCC regulations. The potential for interference with high technology electronic devices would be minimized through project design intended to prevent EMI with identified neighboring uses. Therefore, CEQA does not require mitigation.

Impact EMF/EMI#6: EMI Effects on Schools

The project would use radio systems for the enhanced automatic train control, data transfer, and communications systems, raising the concern that HSR operations could result in EMI with the radio systems in use at nearby schools and colleges. The following 19 schools, universities, and childcare centers were identified within the RSA (12 in Alternative 1, 15 in Alternative 2, and 11 in Alternative 3, and 15 in Alternative 4) (see Table 3.5-11):

- Bellarmine College Preparatory (site 6)
- Gardner Elementary School (site 13)
- Tamien Child Care Center (site 16)
- Charter School of Morgan Hill (site 30)
- Central High School (annex) (site 31)
- Shadow Mountain Baptist School (35)
- El Toro Elementary School (site 36)
- Lewis Britton Middle School (site 37)
- Gavilan College (site 38)
- Barrett Elementary School (site 40)
- San Martin/Gwinn Elementary School (site 42)
- A+ Learning Center Preschool (site 43)
- Rucker Elementary School (site 46)
- Christopher High School (site 48)
- South Valley Middle School (site 50)
- Gilroy Preparatory School (site 51)
- Rebekah Children's Center (site 52)

- Wheeler Tot Lot (site 54)
- Anchorpoint Christian School (site 56)

HSR radio systems would transmit radio signals from antennas located at stations and along the track alignment and on locomotives and train cars. The Authority has acquired two dedicated frequency blocks for use by the enhanced automatic train control systems (Authority 2011b, 2014a, 2016). WiFi frequencies used at HSR stations would be selected to avoid EMI with other users, including WiFi systems used at nearby schools.

The Authority would implement an ISEP during project planning and implementation to support EMC with radio systems operated by neighboring uses, including schools and colleges. From the planning stage through system design, the Authority will perform EMC/EMI safety analyses, which will include identification of existing nearby radio systems, design of systems to prevent EMI with identified neighboring uses, and incorporation of these project features into bid specifications used to procure radio systems (EMI/EMF-IAMF#2).

During operations, the Authority would conduct monitoring and evaluation of system performance to minimize the potential for HSR-generated EMFs to affect school communication systems. Moreover, most radio systems procured for HSR use are expected to be commercial off-the-shelf systems conforming to FCC regulations at 47 C.F.R. Part 15, which contain emissions requirements designed to support EMC among users and systems. The Authority would require all non-commercial off-the-shelf systems procured for HSR use to be certified in conformity with FCC regulations for Part 15, Sub-Part B, Class A devices. HSR radio systems would also meet emissions and immunity requirements contained in the European Committee for Electrotechnical Standardization EN 50121-4 Standard for railway signaling and telecommunications operations (CENELEC 2015) that are designed to support EMC with other radio users.

CEQA Conclusion

The impact under CEQA would be less than significant for all alternatives because radio systems would use frequency blocks dedicated to HSR use by the enhanced automatic train control systems. All HSR equipment would meet FCC regulations (47 C.F.R. Part 15), which would further avoid the potential for interference. Monitoring and evaluation of system performance would be on going during operations to support EMC with other radio users. Therefore, CEQA does not require mitigation.

Impact EMF/EMI#7: Potential for Corrosion of Underground Pipelines and Cables and Adjoining Rail

TPSSs located every 30 miles would deliver AC current to the HSR trains through the OCS, with return current flowing from the trains back to the TPSSs through the steel rails and NF wires. While most return current would be carried back to the TPSS by the NF, some of the rail return current could find a path from the rails to the ground via leakage paths.

Linear metallic objects, such as buried pipelines or cables or adjoining rails, could carry some AC ground current, depending upon the type and water content of the intervening soils (see Section 3.9, Geology, Soils, Seismicity, and Paleontological Resources). AC ground currents have a much lower propensity to cause corrosion in parallel conductors than the DC currents used by rail transit lines, such as Bay Area Rapid Transit or the Los Angeles County Metropolitan Transportation Authority (Hosokawa 2006) (Brenna et al. 2014). Nonetheless, such stray AC currents might cause corrosion by galvanic action.

Because the project must comply with federal regulations, the Authority would require the contractor to follow the ISEP to avoid and minimize the potential for impacts on underground pipelines and cables, including requiring the grounding of pipelines. If adjacent pipelines and other linear metallic structures are not sufficiently grounded through direct contact with earth, the Authority would include additional grounding of pipelines and other linear metallic objects, in coordination with the affected owner or utility, as part of the construction of the HSR system. Alternatively, insulating joints or couplings may be installed in continuous metallic pipes to prevent current flow. All four alternative alignments would be adjacent to pipelines and other

linear metallic structures and include project features (EMI/EMF-IAMF#2) that will minimize the potential for corrosion from ground currents.

CEQA Conclusion

The impact under CEQA would be less than significant for all alternatives because project features would avoid and minimize interference with sensitive equipment from corrosion by arranging for the grounding of nearby ungrounded linear metal structures or insulating metallic pipes to prevent current flow. Therefore, CEQA does not require mitigation.

Impact EMF/EMI#8: Potential for Nuisance Shocks

Nuisance shocks can occur when induced electrical currents build voltage in ungrounded linear metal structures that are capable of conducting electric current. EMFs from the voltage and currents running through the OCS would have the potential to induce voltage and current in nearby conductors, such as ungrounded metal fences and ungrounded metal irrigation systems alongside the HSR alignment. This effect would be more likely where long (1 mile or more), ungrounded fences or irrigation systems run parallel to the HSR and are electrically continuous throughout that distance. Such voltages could potentially cause a nuisance shock to anyone who touches such a fence or irrigation system or any animal that comes into contact with these features. An example of an ungrounded metal irrigation system would be a center pivot system on rubber tires. By contrast, the Vermeer-type metal irrigation system is grounded by its metal wheels, and therefore offers less shock hazard. Any surface pipe-metal irrigation system would be grounded through its contact with the ground. Long, ungrounded fences and metal irrigation systems are more common in rural areas than urban areas. Most metal structures adjacent to the HSR should already be properly grounded through compliance with National Electrical Code guidelines for building and electrical system safety and lightning protections. Nevertheless, the potential exists for unidentified, ungrounded structures along the HSR alignment.

To avoid possible shock hazards to humans or animals, the project design will include grounding of HSR fences, non-HSR parallel metal fences, and parallel metal irrigation systems (with the cooperation of the affected owner or utility) within a specified lateral distance of the HSR alignment (EMI/EMF-IAMF#2). In addition, insulating sections could be installed in fences to prevent the possibility of current flow. Ungrounded fences with a potential for nuisance shocks would be identified as part of the EMC coordination effort (Authority 2014a). Furthermore, modifications to PG&E facilities would be implemented pursuant to the CPUC GO 95 (Rules for Overhead Electric Line Construction) and GO 174 (Rules for Electric Utility Substations), minimizing the potential for nuisance shocks. For cases where fences would be purposely electrified, site-specific insulating measures will be designed and implemented to minimize the potential for nuisance shocks (Authority 2014b). All four project alternatives would be adjacent to parallel metal features and would avoid possible shock hazards by identifying and grounding ungrounded infrastructure.

CEQA Conclusion

The impact under CEQA would be less than significant for all alternatives because project features would avoid and minimize the potential for nuisance shocks by grounding nearby ungrounded linear metal structures or insulating purposely electrified fences to prevent current flow. Consequently, people would not be exposed to a substantial EMF health risk. Therefore, CEQA does not require mitigation.

Impact EMF/EMI #9: Effects on Adjacent Existing Rail Lines

Signal systems control the movement of trains on the existing Union Pacific Railroad (UPRR) tracks that would parallel HSR track for large sections between Scott Boulevard in Santa Clara to Bloomfield Avenue in Gilroy. These signal systems serve three general purposes:

- Warning drivers of street vehicles that a train is approaching. The rail signal system turns on flashing lights and warning bells; some crossings lower barricades to stop traffic.
- Warning train engineers of other train activity on the same track a short distance ahead and advise the engineer that the train should either slow or stop. This is done by using changing,

colored (green, yellow, or red) trackside signals in older railroads and by cab indications in newer railroads.

- Showing railroad dispatchers in a central control center where trains are located on the railway so that train movements can be controlled centrally for safety and efficiency.

Railroad signal systems operate in several ways but generally are based upon the principle that the railcar metal wheels and axles electrically connect the two running rails. AC or DC voltage applied between the rails by a signal system would be shorted out (i.e., reduced to a low voltage) by the rail-to-rail connection of the metal wheel-axle sets of a train. This low-voltage condition is detected and interpreted by the signal system to indicate the presence of a train on that portion of track.

The HSR OCS would carry 60 Hz AC electric currents of up to 930 amperes per train. Interference between the HSR 60 Hz currents and a nearby freight railroad signal system, which will be avoided with incorporation of agreements with railroads (EMI/EMF-IAMF#1), could occur under the following conditions:

- The high electrical currents flowing in the OCS and the return currents in the overhead NF, HSR rails, and ground could induce 60 Hz voltages and currents in existing parallel railroad tracks. If an adjoining freight railroad track parallels the HSR tracks for a long enough distance (i.e., several miles), the induced voltage and current in the adjoining freight railroad tracks could interfere with the normal operation of the signal system so that it indicates there is no freight train present, when in fact one is (or it indicates the presence of a freight train when in fact no train is there). These conditions exist for much of the HSR alignment through the Monterey Highway Corridor and Morgan Hill and Gilroy Subsections, where the HSR alignment would be parallel and adjacent to freight railroad tracks.
- Higher-frequency EMI from several HSR sources (e.g., electrical noise from the contact on the pantograph sliding along the contact conductor, from electrical equipment on board the train, or from the cab radio communication system) could cause electrical interaction with the adjoining freight railroad signal or communication systems.

The EMI concerns for the northern portion of the project alignment have been addressed as part of the proposed PCEP (PCJPB 2016). Within the project extent, this electrification work extends from Scott Boulevard in Santa Clara to Tamien Station in San Jose, encompassing all the San Jose Diridon Station Approach Subsection and a small portion of the Monterey Corridor Subsection. The electrification and upgrades to the blended HSR/Caltrain corridor (see Section 2.5.2, HSR Alternatives for the San Jose to Central Valley Wye Project Extent) would be designed for compatibility with existing signal systems of adjacent freight and passenger rail by ensuring proper electrical grounding and shielding; the installation of specialized components, such as filters, capacitors, and inductors, and the incorporation of design standards to prevent the effects of EMI on signal systems. Furthermore, the Peninsula Joint Powers Board would implement Mitigation Measure EMF-2: Minimize EMI effects during final design, monitor EMI effects during testing, commission and operations, and remediate substantial disruption of sensitive electrical equipment, to reduce EMI impacts to a less than significant level (PCJPB 2015).

There remain large sections of parallel UPRR track, from Tamien Station to Bloomfield Avenue in Gilroy, that would have potential EMI impacts under each alternative:

- Alternative 1—24.4 miles of parallel track
- Alternative 2—31.4 miles of parallel track
- Alternative 3—16.4 miles of parallel track
- Alternative 4—33.0 miles of parallel track

The HSR contractor will work with the engineering departments of freight railroads that parallel the HSR line to apply the standard design practices that a non-electric railroad must use when an electric railroad or electric power lines are installed next to its tracks (EMI/EMF-IAMF#1). These standard design practices include assessment of the specific track signal and communication

equipment in use on nearby sections of existing rail lines, evaluation of potential impacts of HSR EMFs and radio-frequency interference (RFI) on adjoining railroad equipment and application of suitable design provisions on the adjoining rail lines to prevent interference. These standard design and operational practices would prevent the possible effects that HSR operation might otherwise cause: disruption of the safe and dependable operation of the adjacent railroad signal system, resulting in train delays or hazards, or disruption of the road crossing signals, stopping road traffic from crossing the tracks when no train is there (EPRI 2006).

Design provisions often include replacing specific track circuit types on the adjoining rail lines with other types developed for operation on or near electric railways or adjacent to parallel utility power lines, providing filters for sensitive communication equipment and potentially relocating or reorienting radio antennas. These design provisions would be put in place and determined to be adequately effective prior to the activation of potentially interfering systems of the HSR system.

CEQA Conclusion

The impact under CEQA would be less than significant for all alternatives because interference with sensitive equipment of adjacent rail lines would be avoided, and there would be no impact on rail operations. The project features include working with the engineering departments of adjacent parallel railroads to modify or upgrade their signal systems as needed to avoid interference from HSR operations. Therefore, CEQA does not require mitigation.

Impact EMF/EMI#10: EMI Effects on Airports

Airports operate radio and other electronic systems that are potentially susceptible to EMI from other radio systems. The project alternatives pass within approximately 1,600 feet of San Jose International Airport and 1,400 feet of San Martin Airport. Although both airports are outside the RSA, they have been included in this analysis as sensitive receptors given the safety-critical nature of radio-based systems and uncertainties about the location of much of the equipment within each airport.

Airports and commercial aircraft are electronically complex. Navigation systems, such as marker beacons, distance-measuring equipment, traffic-alert and collision-avoidance systems, microwave-landing systems, and global positioning systems, operate across a wide range of radio frequencies. EMI is an ongoing concern for aircraft electronic systems. Historically, EMI from high-powered sources such as radar and broadcast transmitters have resulted in numerous aviation incidents and accidents (Shooman 1994). As a result, such sources are carefully considered in all aspects of design and certification of modern avionics. In addition, the radio spectrum for all aeronautical services has been coordinated and protected by federal law (47 C.F.R. Part 2.106) to minimize the potential of EMI from all other radio services. With one minor exception[7], all communications, instrument landing systems, and navigation services for U.S. aircraft operate in frequency bands exclusively reserved for those purposes. To comply with existing FCC requirements, HSR-related radio services would avoid these frequency bands. This mutually exclusive arrangement would also protect HSR communications systems from EMI due to airport and aircraft emissions.

To minimize interference from HSR communication systems, the Authority has acquired two frequency blocks in the 700 MHz band dedicated to the HSR system (Authority 2016). In addition to avoiding frequency bands used by airport communication systems (since the HSR communication systems are within a dedicated frequency block that is not shared with other users, including airport communication systems), the Authority would require that communications equipment procured for HSR use, including commercial and non-commercial off-the-shelf products, complies with FCC regulations designed to prevent EMI with other equipment. The Authority will comply with the ISEP requirements during project planning and implementation to ensure compatibility with radio systems operated by San Jose International Airport and San Martin Airport (EMI/EMF-IAMF#2). Potential impacts would be avoided through implementation of

[7] Primary Air Surveillance Radars operate in shared-use bands. Even in this case, these shared uses are federally licensed and managed to avoid mutual interference.

EMI/EMF-IAMF#2, which will provide the necessary third-party coordination through the EMCPP and ISEP. During the planning stage through system design, the Authority would perform additional EMC/EMI safety analyses, including:

- Coordination with FAA's Spectrum Engineering Office and airport staff, as necessary
- Identification of existing airport radio systems
- Selection of systems to prevent EMI with identified airport uses, and incorporation of these requirements into bid specifications used to procure radio systems

Recognizing that FAA requirements regarding EMI exceed the normal FCC limits, the implementation stage ISEP would also include monitoring and evaluation of system performance for compatibility with airport systems. This would include verifying that airport radio navigation aids are free of interference from pantograph arcing. Because the same project features would apply for all alternatives, the effects would be the same.

CEQA Conclusion

The impact under CEQA would be less than significant for all alternatives because radio systems used during project operations would not interfere with sensitive equipment at airports. The Authority has acquired dedicated frequency blocks for the HSR system, and all HSR equipment would meet FCC regulations (47 C.F.R. Part 15) for EMI, which would minimize the potential for interference. In addition, during the planning and implementation stage, the Authority would design the HSR systems to prevent EMI with identified neighboring uses and monitor system performance to support ongoing compatibility. Therefore, CEQA does not require mitigation.

3.5.7 Mitigation Measures

There would be no significant impacts under CEQA associated with EMFs or EMI under any of the project alternatives. No mitigation measures are required.

3.5.8 Impact Summary for NEPA Comparison of Alternatives

As described in Section 3.1.6.4, the effects of project actions under NEPA are compared to the No Project condition when evaluating the impact of the project on the resource. The determination of effect is based upon the context and intensity of the change that would be generated by construction and operation of the project. Table 3.5-14 compares the project impacts by alternative, followed by a summary of the impacts.

Temporary construction activity for all four project alternatives would cause fluctuations in EMF levels, although the practical effects would be limited to within 50 feet of the project footprint and comply with FCC regulations. EMF fluctuations that could be generated by construction vehicle movements related to Alternative 2 would attenuate below background levels at all construction locations adjacent to facilities known to have sensitive equipment, and, therefore, construction activities would not affect any sensitive equipment at these locations because of shifts in the magnetic field. Similarly, EMFs generated during construction of all of the four alternatives would not exceed levels which could affect human health or livestock and poultry productivity. Potential interference with sensitive equipment associated at the Butterfield Professional Center under Alternatives 1, 3, and 4 will be addressed through compliance with federal and state laws requiring the project to avoid EMI (EMI/EMF-IAMF#2).

Radio communications systems would comply with FCC regulations designed to prevent EMI, which would avoid interference with equipment operated by nearby railroads, airports, schools, or other businesses. The potential for interference with medical and other high-technology electronic devices would be minimized through project design intended to prevent EMI with identified neighboring uses. In addition, the Authority would coordinate with third parties to identify nearby sensitive equipment with the potential to be affected by the HSR system and, if necessary, identify appropriate mitigation to avoid these effects, including performing tests to confirm equipment is not adversely affected.

Table 3.5-14 Comparison of Project Alternative Impacts for EMFs and EMI

Impacts	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact EMF/EMI#1: Temporary Impacts from Use of Construction Equipment	Construction activities would occur more than 50 feet from facilities with known sensitive equipment. Therefore, these facilities would not be exposed to EMF generated by construction equipment. No individuals would be exposed to EMF levels that exceed human health standards. EMF generated during construction would be below levels known to disrupt agricultural activities.	Temporary construction activity would cause fluctuations in EMF levels, although the practical effects would be limited to within 50 feet of the project footprint and would comply with FCC regulations. No individuals would be exposed to EMF levels that exceed human health standards. Construction activities would occur within 15 feet of the Butterfield Professional Center, a facility with known sensitive equipment. EMF generated during construction would be below levels known to disrupt agricultural activities.	Same as Alternative 1	Same as Alternative 1
Impact EMF/EMI#2: Permanent Human Exposure to EMFs	HSR operations would expose the general public and HSR employees and passengers to EMF inside and outside the HSR system. Inside the HSR system, EMF exposure levels would be below the most restrictive MPE limits. Outside the HSR system, EMF levels would not exceed the MPE thresholds for humans.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1 without the design variants. With the design variants, HSR train operations would generate slightly higher EMFs in the DDV and TDV areas than the alternatives without the DDV and TDV.
Impact EMF/EMI#3: Exposure of People with Implanted Medical Devices to EMFs	EMF levels generated inside traction power distribution and interconnection facilities and produced by emergency standby generators would be above the recommended limits for people with implanted medical devices. However, the public and workers with implanted medical devices would be restricted from accessing these facilities.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Impacts	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact EMF/EMI#4: Livestock and Poultry Exposure	Several studies documented that EMFs do not affect livestock or poultry productivity and would therefore not disrupt nearby agricultural activities. The three livestock and poultry operations in the RSA would be unaffected by operation of HSR trains.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact EMF/EMI#5: Interference with Sensitive Equipment	The RSA includes one facility with sensitive equipment; however, this facility would not be exposed to a magnetic shift greater than 2 mG.	The RSA includes three facilities with sensitive equipment, two of which would be exposed to a magnetic shift greater than 2 mG. The Authority would coordinate with third parties to identify sensitive equipment at the known receptors and, if necessary, identify appropriate mitigation, including performing tests to confirm equipment is not adversely affected.	The RSA includes two facilities with sensitive equipment, although neither would be exposed to a magnetic shift greater than 2 mG.	The RSA includes three facilities with sensitive equipment, two of which would be exposed to a magnetic shift greater than 2 mG. Coordination with third parties would be the same as under Alternative 2.
Impact EMF/EMI#6: EMI Effects on Schools	Dedicated frequency blocks for the HSR system and compliance with FCC regulations for all HSR equipment would not generate interference at the 12 schools within the Alternative 1 RSA.	Same as Alternative 1 for the 15 schools within the Alternative 2 RSA.	Same as Alternative 1 at the 11 schools within the Alternative 3 RSA.	Same as Alternative 1 at the 15 schools within the Alternative 4 RSA.
Impact EMF/EMI#7: Potential for Corrosion of Underground Pipelines and Cables and Adjoining Rail	The project would ground adjacent ungrounded linear metal structures or insulate metallic pipes to prevent current flow that could result in corrosion.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Impacts	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact EMF/EMI#8: Potential for Nuisance Shocks	The project would ground nearby ungrounded linear metal structures or insulate purposely electrified fences to prevent current flow.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Impact EMF/EMI#9: Effects on Adjacent Existing Rail Lines	There are 24.4 miles of parallel UPRR track susceptible to EMI impacts under Alternative 1. Project features include working with the engineering departments of adjacent parallel railroads to modify or upgrade their signal systems to prevent interference from HSR generated EMI.	There are 31.4 miles of parallel UPRR track susceptible to EMI impacts under Alternative 2. Project features would be the same as Alternative 1.	There are 16.4 miles of parallel UPRR track susceptible to EMI impacts under Alternative 3. Project features would be the same as Alternative 1.	There are 33.0 miles of parallel UPRR track susceptible to EMI impacts under Alternative 4. Project features would be the same as Alternative 1.
Impact EMF/EMI#10: EMI Effects on Airports	The project alternatives would pass within 1,600 feet of San Jose International Airport and within 1,400 feet of San Martin Airport. HSR communications equipment would use dedicated frequency allocations, and relevant FAA engineering offices would be consulted during project design to confirm no interference.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Authority = California High-Speed Rail Authority
CEQA = California Environmental Quality Act
EMF = electromagnetic fields
EMI = electromagnetic interference
FAA = Federal Aviation Administration
FCC = Federal Communications Commission
HSR = high-speed rail
MPE = maximum permissible exposure
NEPA = National Environmental Policy Act
RSA = resource study area
UPRR = Union Pacific Railroad

EMF levels exceeding those that would be generated by the HSR system have been documented not to affect livestock and poultry productivity. As a result, none of the four alternatives would disrupt agricultural operations.

The public and workers with implanted medical devices would be restricted from accessing traction power distribution facilities, interconnection facilities, and emergency standby generator facilities, avoiding potential interference with these devices. The public and workers with implanted medical devices would therefore not be exposed to harmful EMF levels at traction power distribution facilities, interconnection facilities, and emergency standby generators. These facilities would be inaccessible to the general public, and the ISEP would restrict workers with implanted medical devices from accessing traction power distribution facilities, interconnection facilities, and emergency standby generators. In addition, signs posted around these facilities would warn persons with implanted medical devices of high levels of EMFs.

The project includes project features (EMI/EMF-IAMF#2) that will avoid interference with sensitive equipment that could result from a shift in the magnetic field from HSR operations. RF interference would be avoided because the project includes use of dedicated frequency blocks and procurement of communications equipment meeting FCC regulations. The potential for interference with medical and other high technology electronic devices would be minimized through project design intended to prevent EMI with identified neighboring uses. In addition, the Authority would coordinate with third parties to identify nearby sensitive equipment with the potential to be affected by the HSR system and, if necessary, identify appropriate mitigation to avoid these effects, including performing tests to confirm equipment is free from impacts.

Dedicated frequency blocks for the HSR system and compliance with FCC regulations for all HSR equipment would avoid the potential for interference at schools. The HSR radio system would use dedicated frequency blocks, and all HSR equipment would meet FCC regulations (47 C.F.R. Part 15), thereby minimizing potential EMI with school equipment. In addition, during the planning stage, the Authority would identify users of existing nearby radio systems and design the HSR systems to prevent EMI with identified neighboring uses.

To preclude possible interference with adjacent existing rail lines, the HSR contractor will work with the engineering departments of freight railroads that parallel the HSR line to apply the standard design practices that a non-electric railroad must use when an electric railroad or electric power lines are installed next to its tracks (EMI/EMF-IAMF#1). These standard design practices include assessment of the specific track signal and communication equipment in use on nearby sections of existing rail lines, evaluation of potential impacts of HSR EMFs and RFI on adjoining railroad equipment and application of suitable design provisions on the adjoining rail lines to prevent interference. Ground currents generated by operation of the project are not expected to result in potential corrosion of adjoining rail. Features of the project include arranging for the grounding of nearby ungrounded linear metal structures or insulating metallic pipes to prevent current flow so that corrosion will not occur. The project also would ground nearby ungrounded linear metal structures so that electric shocks would not occur. In the case of purposely electrified fences, site-specific insulating measures will be designed and implemented.

Effects on adjacent railroad lines and facilities from operations of the project alternatives would be avoided through preconstruction design coordination with adjacent railroads to modify or upgrade their signal systems as needed to avoid interference from HSR operations. Alternative 4 has the greatest amount of adjacent railroad facilities with 33.0 miles of parallel track, followed by Alternatives 2, 1, and 3 with 31.4 miles, 24.7 miles, and 16.4 miles, respectively.

The HSR radio system would use dedicated frequency blocks and meet FCC regulations (47 C.F.R. Part 15) for EMI. HSR equipment would be selected in consultation with FAA RFI specialists. Dedicated frequency allocations for HSR communications equipment and coordination with the relevant FAA engineering offices during the project design would avoid the potential for any interference with sensitive systems. The effect would be the same for all project alternatives.

3.5.9 CEQA Significance Conclusions

As described in Section 3.1.6.4, the impacts of project actions under CEQA are evaluated against thresholds to determine whether a project action would result in no impact, a less than significant impact, or a significant impact. Table 3.5-15 identifies the CEQA significance determinations for each impact discussed in Section 3.5.6, Environmental Consequences.

Table 3.5-15 CEQA Significance Conclusions and Mitigation Measures for the EMFs and EMI

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measure	CEQA Level of Significance after Mitigation
Impact EMF/EMI#1: Temporary Impacts from Use of Construction Equipment	Less than significant for all alternatives: Preconstruction review and project features will comply with federal and state laws requiring the project to avoid EMI.	No mitigation measures are required	N/A
Impact EMF/EMI#2: Permanent Human Exposure to EMFs	Less than significant for all alternatives: EMF levels inside and outside the HSR system would not exceed the MPE thresholds for humans.	No mitigation measures are required	N/A
Impact EMF/EMI#3: Exposure of People with Implanted Medical Devices to EMFs	Less than significant for all alternatives: The public and workers with implanted medical devices would be restricted from accessing these facilities.	No mitigation measures are required	N/A
Impact EMF/EMI#4: Livestock and Poultry Exposure	Less than significant for all alternatives: EMF generated during construction would be below levels known to disrupt agricultural activities.	No mitigation measures are required	N/A
Impact EMF/EMI#5: Interference with Sensitive Equipment	Less than significant for all alternatives: Coordination with third parties will identify sensitive equipment, develop measures to avoid interference and perform tests to confirm equipment is free from impacts.	No mitigation measures are required	N/A
Impact EMF/EMI#6: EMI Effects on Schools	Less than significant for all alternatives: Dedicated frequency blocks for the HSR system and compliance with FCC regulations for all HSR equipment would avoid interference with schools.	No mitigation measures are required	N/A
Impact EMF/EMI#7: Potential for Corrosion of Underground Pipelines and Cables and Adjoining Rail	Less than significant for all alternatives: The project would ground nearby ungrounded linear metal structures or insulate metallic pipes to prevent current flow.	No mitigation measures are required	N/A

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measure	CEQA Level of Significance after Mitigation
Impact EMF/EMI#8: Potential for Nuisance Shocks	Less than significant for all alternatives: The project would ground nearby ungrounded linear metal structures or insulate purposely electrified fences to prevent current flow.	No mitigation measures are required	N/A
Impact EMF/EMI#9: Effects on Adjacent Existing Rail Lines	Less than significant for all alternatives: The project would work with adjacent parallel railroads to modify or upgrade their signal systems to avoid interference from HSR operations.	No mitigation measures are required	N/A
Impact EMF/EMI #10: EMI Effects on Airports	Less than significant for all alternatives: The project would use dedicated frequency allocations for HSR communications equipment and coordinate with the relevant FAA engineering offices during project design to avoid interference with sensitive systems.	No mitigation measures are required	N/A

N/A = not applicable

3.6 Public Utilities and Energy

Since publication of the Draft Environmental Impact Report (EIR)/Environmental Impact Statement (EIS), the following substantive changes have been made to this section:

- Section 3.6.2.1, Federal, was updated regarding the Federal Railroad Administration (FRA) Procedures for Considering Environmental Impacts. Footnotes were added regarding FRA's Environmental Procedures and the updated Council on Environmental Quality (CEQ) regulations issued after release of the Draft EIR/EIS.
- The definition of public utilities in Section 3.6.1, Introduction, was revised to state that major utilities include wastewater lines that have an outside diameter equal to or greater than 24 inches. Section 3.6.1 was also revised to note that fiber optics are not major utilities.
- The text box in Section 3.1, Introduction, was updated to reflect the revised number of major utility conflicts and the revised decreases in energy consumption.
- Section 3.6.2.1 was revised to reflect updates to the Corporate Average Fuel Economy Standards. In April 2021, the National Highway Transportation Safety Administration (NHTSA) issued a notice of proposed rulemaking to repeal the SAFE Vehicles Rule. On August 10, 2021, NHTSA issued a notice of proposed rulemaking to amend the CAFE standards set in 2020 for passenger cars and light trucks manufactured in model years 2024-2026.
- A table note to Table 3.6-2 was revised to clarify that the Delta-Mendota Canal, which is part of the Central Valley Project (CVP), is owned by the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) and operated by the San Luis and Delta-Mendota Water Authority (SLDMWA) on behalf of Reclamation pursuant to an operation and maintenance agreement.
- The number of major utility lines within the public utility resource study area (RSA) was updated for all alternatives in Table 3.6-3.
- The Potable Water Suppliers subsection in Section 3.6.5.1, Public Utilities, was revised to include a description of the designation of the Santa Clara Valley Water District as a Groundwater Sustainability Agency pursuant to the Sustainable Groundwater Management Act and to include Reclamation infrastructure that is owned and maintained by the Santa Clara Valley Water District (SCVWD; now known as Valley Water). Figures 3.6-4 and 3.6-5 were revised to show the locations of the San Felipe Division infrastructure. In response to comments, the text describing Edenvale, Coyote Valley, and Evergreen in Section 3.6.5.1 was revised.
- The Nonpotable Water Suppliers subsection in Section 3.6.5.1 was updated to state that the CVP provides agricultural and municipal water to numerous water districts in Merced County. In this section, a sentence stating groundwater sustainability plans are being prepared for each subbasin with the objective of achieving basin sustainability by the year 2040 was removed from the discussion of SLDMWA.
- The Wastewater Collection and Treatment subsection in Section 3.6.5.1 was revised to update the number of sewage lift stations that convey to the San Jose-Santa Clara Regional Wastewater Facility.
- The Stormwater Management subsection in Section 3.6.5.1 was revised to update the number of miles of storm drain lines and the number of catch basins and stormwater pump stations in the City of San Jose's storm drainage system.
- The number of public utility lines in the RSA was updated for all alternatives, and additional discussion relating to the impact of the change in alignment related to the Diridon design variant (DDV) under Alternative 4 was added in Impact PUE#1.

- Impact PUE#2 text was updated to include a summary of the potential reduction in water use from construction of the alternatives. The text of the California Environmental Quality Act (CEQA) Conclusion for Impact PUE#2 was revised for clarity. The CEQA Conclusion for Impact PUE#2 remains less than significant.
- Impact PUE#3 text and Table 3.6-13 were revised to update the number of utility conflicts for each alternative.
- Impact PUE#4 was revised to acknowledge the potential for impacts on groundwater wells and pump stations, specifically the relocation of the Diana Well under Alternative 2 and Alternative 4. Impact PUE#4 was also revised to clarify the description of the SCVWD percolation basins.
- Impacts PUE#5 and PUE#12 were updated to include a discussion of the effects of the tunnel design variant (TDV) on utilities.
- Impacts PUE#5 and PUE#6 were revised to state that local water management authority and State Water Resources Control Board (SWRCB) permittees are required to produce a stormwater pollution prevention plan (SWPPP) prepared by a qualified developer or practitioner.
- Impacts PUE#6 and PUE#9 were revised to address capacity and maintenance of wastewater pump stations.
- Impact PUE#8 was modified to clarify that landscaping irrigation is included as one of the outdoor uses at San Jose Diridon Station and Gilroy Station. The text of the CEQA Conclusion for Impact PUE#8 was revised for clarity. The CEQA Conclusion for Impact PUE#8 remains less than significant.
- The text of the CEQA Conclusion for Impact PUE#9 was revised for clarity. The CEQA Conclusion for Impact PUE#9 remains less than significant.
- Impact PUE#13 was updated to include discussion of energy use relating to increased train speeds in the TDV and DDV.
- In Section 3.6.7, Mitigation Measures, PUE-MM#1 was modified slightly to clarify the timeframe for implementation of this mitigation measure.
- In Section 3.6.8, Impact Summary for NEPA Comparison of Alternatives, text and Table 3.6-22 were updated to reflect the revised number of major utility lines for all four alternatives.
- Where appropriate, the verb “would,” when used specifically to describe impact avoidance and minimization features (IAMFs) or mitigation measures, as well as their directly related activities, was changed to “will,” indicating their integration into project design.

3.6.1 Introduction

This section describes the public utilities and energy resources in the San Jose to Central Valley Wye Project Extent (project) RSA where public utilities and energy are most susceptible to change as a result of construction and operation of the project. This analysis evaluates potential project impacts on utility services, access to the right-of-way, water use, waste generation, storm drain facilities, and energy consumption.

The following appendices in Volume 2 of this Final EIR/EIS provide additional details on public utilities and energy:

- Appendix 2-C, Operations and Service Plan Summary, provides background information on the intended service and operations of the high-speed rail (HSR) system.
- Appendix 2-D, Applicable Design Standards, describes the relevant design standards for the project.
- Appendix 2-E, Project Impact Avoidance and Minimization Features, provides a list of all IAMFs incorporated into this project.
- Appendix 2-J, Regional and Local Plans and Policies, provides a list by resource of all applicable regional and local plans and policies.
- Appendix 3.6-A, Public Utilities and Energy Facilities, provides a list of existing utilities and energy facilities in the public utilities RSA and a determination of whether relocation or protection in place would be required.
- Appendix 3.6-B, Existing Plus Project Conditions Energy Analysis, compares existing physical conditions for the energy analysis to the existing plus project conditions to estimate statewide energy use with and without the HSR project.
- Appendix 3.6-C, Water Use Assessment, provides an analysis and evaluation of anticipated water use requirements for construction and operation of the project.
- Appendix 3.6-D, Energy Analysis Memorandum, describes the calculation of statewide energy consumption as well as criteria pollutant and greenhouse gas (GHG) emission levels associated with future operation of the HSR system, which were used in this analysis.

Public Utilities

Public utilities impacts include major utility lines (electricity, natural gas, petroleum, water, communications) in the right-of-way of the project alternatives that would need to be relocated, removed, protected in place, abandoned in place, extended, or realigned during construction. Alternative 1 would result in 212 major utility conflicts; Alternative 2 would result in 303 major utility conflicts; Alternative 3 would result in 202 major utility conflicts; and Alternative 4 would result in 404 major utility conflicts.

Public utility impacts also include water consumption; construction of the project would consume between 3,905 and 4,251 acre-feet of water, depending on the alternative.

Energy

Energy resource impacts include energy consumption for construction and operation; Alternative 1 would consume 22,760 billion British thermal units (Btus) of energy for construction; Alternative 2 would consume 28,750 billion Btus; Alternative 3 would consume 24,010 billion Btus; and Alternative 4 would consume 29,290 billion Btus. Operations would result in a net decrease in energy consumption of 6,335,230 MMBtu per year for medium ridership scenario and a net decrease of 6,709,070 million Btu per year for the high ridership scenario in 2040. Network upgrades and electric utility infrastructure would be constructed to supply electricity to the HSR system, including traction power switching stations, paralleling stations, and reconductoring of overhead electrical lines.

Public utilities and energy resources are important factors for construction and operation of the project. Construction of the project would require the relocation of public utilities, potentially resulting in impacts on the utilities and utility services. HSR operations would also require network upgrades for electricity supply, potentially affecting public utilities beyond the project footprint. Construction and operation of the project would also consume energy, including electricity, natural gas, and petroleum products, potentially affecting energy supply. This section also considers energy demand when viewed on a system-wide basis, because HSR operation would

affect energy consumption for other modes of transportation. The following six EIR/EIS resource sections provide additional information related to public utilities and energy:

- Section 3.2, Transportation, evaluates impacts on traffic, including road closures and roadway access as a result of utility relocations during project construction.
- Section 3.3, Air Quality and Greenhouse Gases, evaluates impacts on air quality and GHG emissions from construction and operation of the project.
- Section 3.5, Electromagnetic Fields and Electromagnetic Interference, evaluates impacts of the project on sensitive land uses that are susceptible to potential impacts from electromagnetic fields and electromagnetic interference.
- Section 3.8, Hydrology and Water Resources, evaluates impacts of the project on drainage and stormwater management infrastructure and utility systems along the alignment during construction.
- Section 3.11, Safety and Security, evaluates impacts of high-risk facilities including natural gas and crude oil liquid pipelines, electric transmission lines, and water lines.
- Section 3.14, Agricultural Farmland, evaluates impacts of the project on agricultural farmland and the disruption of utilities and irrigation infrastructure and power systems.

Key Definitions

The following are definitions for public utilities and energy resources analyzed in this Final EIR/EIS.

- **Public utilities**—Public utilities are defined as any subsurface, aboveground, or overhead facility used for transmission, regardless of size, shape, or method of conveyance. This impact evaluation focuses on major public utilities, which include the following types of facilities:
  - Electrical substations
  - High-voltage electrical lines (50 kilovolts [kV] or greater)
  - High-pressure natural gas pipelines of ≥ 20-inch outside diameter
  - Petroleum (crude oil) and petroleum product fuel pipelines of ≥ 20-inch outside diameter
  - Water lines (including potable and irrigation water lines) of outside diameter ≥ 20 inches
  - Wastewater lines of outside diameter ≥ 24 inches
  - Stormwater canals, conduits, and pipes of outside diameter ≥ 42 inches

  Some fiber optic lines and telecommunication cables have also been included in the analysis where information about them was available; however, they are not considered to be major utilities.
- **Energy**—Energy is commonly measured in terms of British thermal units (Btu). A Btu is defined as the amount of heat required to raise the temperature of 1 pound of water by 1 degree Fahrenheit. For transportation projects, energy usage is predominantly influenced by the amount of fuel used for construction and operation. The average Btu content of fuels is the heat value (or energy content) per quantity of fuel as determined from tests of fuel samples. For example, a gallon of gasoline produces approximately 120,000 Btu (U.S. Energy Information Administration [EIA] 2017a); however, the Btu value of gasoline varies from season to season and from batch to batch. The Btu is the unit of measure used to quantify the overall energy impacts expected to result from construction and operations of the HSR.

- **Transportation energy**—Transportation energy is generally defined in terms of direct and indirect energy.
  - Direct energy involves all energy consumed by vehicle propulsion (e.g., automobiles, trains, airplanes). This energy is a function of traffic characteristics such as volume, speed, distance traveled, vehicle mix, and thermal value of the fuel being used. Direct energy also includes the electrical power requirements of the HSR system, including recoverable energy during HSR train braking.
  - Indirect energy consumption involves the nonrecoverable, one-time energy expenditure involved in constructing the physical track and systems associated with the project, typically through the irreversible burning of hydrocarbons for operating equipment and vehicles in which energy is lost to the environment and consumption of electricity for lighting, operation of equipment, and other purposes.

3.6.2 Laws, Regulations, and Orders

This section presents federal and state laws, regulations, and orders applicable to public utilities and energy. The California High-Speed Rail Authority (Authority) would implement the HSR system, including the project, in compliance with all federal and state regulations. Volume 2, Appendix 2-J, provides regional and local plans and policies relevant to public utilities and energy considered in the preparation of this analysis.

3.6.2.1 Federal

Federal Railroad Administration, Procedures for Considering Environmental Impacts (64 Fed. Reg. 28545)

On May 26, 1999, FRA released *Procedures for Considering Environmental Impacts* (FRA 1999). These FRA procedures supplement the Council on Environmental Quality Regulations (40 C.F.R. Part 1500 et seq.) and describe the FRA's process for assessing the environmental impacts of actions and legislation proposed by the agency and for the preparation of associated documents (42 U.S. Code 4321 et seq.).[1,2] The FRA *Procedures for Considering Environmental Impacts* states that "the EIS should identify any significant changes likely to occur in the natural environment and in the developed environment. The EIS should also discuss the consideration given to design quality, art, and architecture in project planning and development as required by U.S. Department of Transportation Order 5610.4." These FRA procedures state that an EIS should consider possible impacts on public utilities and energy resources.

Section 403(b) of the Power Plant and Industrial Fuel Use Act (USEO 12185; 44 Fed. Reg. 75093; Public Law 95-620)

Section 403(b) of the Power Plant and Industrial Fuel Use Act and of USEO 12185 encourages additional conservation of petroleum and natural gas by recipients of federal financial assistance.

Norman Y. Mineta and Special Programs Improvement Act (Public Law 108-426)

The Norman Y. Mineta and Special Programs Improvement Act established the U.S. Department of Transportation's (USDOT) Pipeline and Hazardous Materials Safety Administration and regulates safe movement of hazardous materials to industry and consumers by all modes of transportation, including pipelines. The law requires pipeline owners and operators to meet specific standards and qualifications, including participating in public safety programs that notify

[1] While this EIR/EIS was being prepared, FRA adopted new NEPA compliance regulations (23 C.F.R. 771). Those regulations only apply to actions initiated after November 28, 2018. See 23 C.F.R. 771.109(a)(4). Because this EIR/EIS was initiated prior to that date, it remains subject to FRA's Environmental Procedures rather than the Part 771 regulations.

[2] The Council on Environmental Quality issued new regulations on July 14, 2020, effective September 14, 2020, updating the NEPA implementing procedures at 40 C.F.R. Parts 1500-1508. However, this project initiated NEPA before the effective date and is not subject to the new regulations, relying on the 1978 regulations as they existed prior to September 14, 2020. All subsequent citations to Council on Environmental Quality regulations in this environmental document refer to the 1978 regulations, pursuant to 40 C.F.R. 1506.13 (2020) and the preamble at 85 Fed. Reg. 43340.

an operator of proposed demolition, excavation, tunneling, or construction near or affecting a pipeline. This includes identifying pipelines that may be affected by such activities and identifying any hazards that may affect a pipeline. In California, the Office of the Fire Marshal administers pipeline safety.

Federal Energy Regulatory Commission

The Federal Energy Regulatory Commission (FERC) is an independent agency that regulates the interstate transmission of natural gas, oil, and electricity. FERC also regulates natural gas and hydropower projects. As part of that responsibility, FERC regulates the transmission and sale of natural gas for resale in interstate commerce, the transmission of oil by pipeline in interstate commerce, and the transmission and wholesale sales of electricity in interstate commerce. FERC also licenses and inspects private, municipal, and state hydroelectric projects; approves the siting and abandonment of interstate natural gas facilities, including pipelines, storage, and liquefied natural gas; oversees environmental matters related to natural gas and hydroelectricity projects and major electricity policy initiatives; and administers accounting and financial reporting regulations and conduct of regulated companies.

Corporate Average Fuel Economy Standards

Corporate Average Fuel Economy (CAFE) standards are federal regulations to reduce energy consumed by on-road motor vehicles. The USDOT's National Highway Traffic Safety Administration (NHTSA) regulates the standards, and the U.S. Environmental Protection Agency (USEPA) measures vehicle fuel efficiency. The standards specify minimum fuel consumption efficiency standards for new automobiles sold in the United States.

The updated standards apply to new passenger cars, light-duty trucks, and medium-duty passenger vehicles, covering model years 2017 through 2025, and are equivalent to 54.5 miles per gallon. On August 2, 2018, the NHTSA and USEPA proposed to amend the fuel efficiency standards for passenger cars and light trucks and establish new standards covering model years 2021 through 2026 by maintaining the current model year 2020 standards through 2026 (SAFE Vehicles Rule). On September 19, 2019, USEPA and NHTSA issued a final action on the One National Program Rule, which is considered Part One of the SAFE Vehicles Rule and a precursor to the proposed fuel efficiency standards. The One National Program Rule enables USEPA/NHTSA to provide nationwide uniform fuel economy and GHG vehicle standards, specifically by 1) clarifying that federal law preempts state and local tailpipe GHG standards, 2) affirming NHTSA's statutory authority to set nationally applicable fuel economy standards, and 3) withdrawing California's CAA preemption waiver to set state-specific standards. USEPA and NHTSA published their decisions to withdraw California's waiver and finalize regulatory text related to the preemption on September 27, 2019 (84 Fed. Reg. 51310). California, 22 other states, the District of Columbia, and two cities filed suit against Part One of the SAFE Vehicles Rule on September 20, 2019 *(California et al. v. United States Department of Transportation et al.*, 1:19-cv-02826, U.S. District Court for the District of Columbia). On October 28, 2019, the Union of Concerned Scientists, Environmental Defense Fund, and other groups filed a protective petition for review after the federal government sought to transfer the suit to the D.C. Circuit (*Union of Concerned Scientists v. National Highway Traffic Safety Administration*). The lawsuit filed by California and others is stayed pending resolution of the petition.

USEPA and NHTSA published final rules to amend and establish national CO_2 and fuel economy standards on April 30, 2020 (Part Two of the SAFE Vehicles Rule) (85 Fed. Reg. 24174). The revised rule changes the national fuel economy standards for light duty vehicles from 50.4 miles per gallon to 40.5 miles per gallon in future years. California, 22 other states, and the District of Columbia filed a petition for review of the final rule on May 27, 2020.

On January 20, 2021, President Joseph Biden issued an executive order directing the USEPA and NHTSA to review the SAFE Vehicles Rule and propose a new rule suspending, revising, or rescinding it. On April 22, 2021, NHTSA issued a notice of proposed rulemaking to repeal the SAFE Vehicles Rule (49 C.F.R. Parts 531 and 533). On August 10, 2021, NHTSA issued a notice of proposed rulemaking to amend the CAFE standards set in 2020 for passenger cars and light

trucks manufactured in model years 2024-2026, so that standards would increase in stringency at a rate of 8% per year rather than the 1.5% year set previously.

Resource Conservation and Recovery Act (42 United States Code § 6901 et seq.)

The Resource Conservation and Recovery Act (RCRA) was enacted in 1976 to oversee proper management of solid and hazardous wastes, from their generation to ultimate disposal or destruction. Implementation of the RCRA has largely been delegated to federally approved state waste management programs and, under Subtitle D, further promulgated to local governments for management of planning, regulation, and implementation of nonhazardous solid waste disposal. The USEPA retains oversight of state actions under 40 Code of Federal Regulations (C.F.R.) Parts 239–259. Where facilities are found to be inadequate, 40 C.F.R. Section 256.42 requires that necessary facilities and practices be developed by the responsible state and local agencies or by the private sector. In California, that responsibility was created under the California Integrated Waste Management Act of 1989 and Assembly Bill (AB) 939.

3.6.2.2 State

Public Utilities Code Sections 1001–1013 and California Public Utilities Commission General Order 131-D

The California Public Utilities Commission (CPUC) regulates public electric utilities in California. Sections 1001–1013 of the Public Utilities Code require railroad companies operating railroads primarily powered by electric energy or electric companies operating power lines not to begin construction of electric railroads or power lines without first obtaining a certificate from the CPUC specifying that the construction is required for the public's convenience and necessity. General Order 131-D establishes CPUC rules for implementing Public Utilities Code Sections 1001–1013 relating to the planning and construction of electric generation, transmission/power/distribution line facilities, and substations in California. A permit to construct must be obtained from CPUC for facilities between 50 kV and 200 kV. A certificate of public convenience and necessity (CPCN) must be obtained from the CPUC for facilities 200 kV and above. Both the permit to construct and CPCN are discretionary decisions by CPUC that are subject to the CEQA.

Rules for Overhead 25 kV Railroad Electrification Systems for a High-Speed Rail System (California Public Utilities Commission General Order 176)

The Rules for Overhead 25 kV Railroad Electrification Systems for a High-Speed Rail System became effective March 26, 2015. The rules establish uniform safety requirements governing the design, construction, operation, and maintenance of 25-kV alternating current (AC) railroad electrification overhead contact systems. The CPUC General Order would apply to the HSR system.

General Order 176 applies to 25-kV AC electrification systems constructed in California and serving an HSR passenger system capable of operating at speeds of 150 miles per hour or higher, in dedicated rights-of-way with no public highway-rail at-grade crossings and in which freight operations do not occur. General Order 176 promotes the safety and security of the general public and of persons engaged in the construction, maintenance, and operation of a 25-kV electrified HSR system.

The base standards for design, construction, installation, operation, and maintenance established by General Order 176 require coordination and cooperation of the Authority (the entity that owns the HSR system) and other facility owners (e.g., Pacific Gas and Electric Company [PG&E]) so that the facilities of both parties are not prevented from performing as required or intended. General Order 176 does not prevent the Authority from entering into agreements with other facility owners that establish stricter standards than or additional requirements to those specified in these rules.

Designation of Transmission Corridor Zones (California Code of Regulations, Title 20, §§ 2320–2340)

The regulation on Designation of Transmission Corridor Zones specifies the scope and process required for identification, evaluation, and designation of new transmission corridor zones.

Energy Efficiency Standards (California Code of Regulations, Title 24, Part 6)

The Energy Efficiency Standards promote efficient energy use in new buildings constructed in California. The standards regulate energy consumed for heating, cooling, ventilation, water heating, and lighting. The standards are enforced through the local building permit process.

Renewables Portfolio Standard Program (SB 1078)

Senate Bill (SB) 1078 established the Renewables Portfolio Standard (RPS) Program, requiring retail sellers of electricity to increase their purchases of electricity generated by renewable sources and establishing a goal of having 20 percent of California's electricity generated by renewable sources by 2017. In 2010, the California Air Resources Board (CARB) extended this target for renewable energy resource use to 33 percent of total use by 2020 (CPUC 2017). In October 2015, Governor Edmund G. Brown, Jr. signed SB 350, which requires retail sellers and publicly owned utilities to procure 50 percent of their electricity from eligible renewable energy resources by 2030. Increasing California's renewable supplies will diminish the state's heavy dependence on natural gas as a fuel for electric power generation.

100 Percent Clean Energy Act (SB 100)

SB 100, the 100 Percent Clean Energy Act of 2018, makes it a policy of the state that eligible renewable energy resources and zero-carbon resources supply 100 percent of all retail sales of electricity to California end-use customers and 100 percent of electricity procured to serve all state agencies by December 31, 2045.

Integrated Waste Management Act (AB 939)

The California Integrated Waste Management Act of 1989 was enacted by AB 939 in response to the RCRA. It requires cities and counties to prepare an integrated waste management plan, including a countywide siting element (CSE), for each jurisdiction. Per California Public Resources Code Sections 41700–41721.5, the CSE provides an estimate of the total permitted disposal capacity needed for a 15-year period, or whenever additional capacity is necessary. CSEs in California must be updated by each operator and permitted by Department of Resources Recycling and Recovery, which is within the Natural Resources Agency, every 5 years. AB 939 mandated that local jurisdictions meet solid waste diversion goals of 50 percent by 2000.

Sustainable Communities and Climate Protection Act of 2008 (SB 375, Chapter 728, Statutes of 2008)

Adopted in September 2008, SB 375 provides a new planning process to coordinate community development and land use planning with regional transportation plans (RTP) in an effort to reduce sprawling land use patterns and dependence on private vehicles and thereby reduce vehicle miles traveled (VMT) and GHG emissions associated with VMT. SB 375 is one major tool to meet the goals in the Global Warming Solutions Acts (AB 32). Under SB 375, CARB sets GHG emission reduction targets for 2020 and 2035 for the metropolitan planning organizations in the state. Each metropolitan planning organization must then prepare a sustainable communities strategy that meets the GHG emission reduction targets set by CARB. The sustainable communities strategy has been incorporated into the region's RTP.

Local Government Construction and Demolition Guide (SB 1374)

SB 1374 seeks to assist jurisdictions with diverting construction and demolition (C&D) material, with a primary focus on CalRecycle, by developing and adopting a model C&D diversion ordinance for voluntary use by California jurisdictions.

Protection of Underground Infrastructure (California Government Code § 4216)

Protection of Underground Infrastructure regulation requires an excavator to contact a regional notification center (i.e., underground service alert) at least 2 days before excavation of any subsurface installations. The underground service alert then notifies utilities that may have buried lines within 1,000 feet of the excavation. Representatives of the utilities must mark the specific location of their facilities within the work area prior to the start of excavation. The construction contractor must probe and expose the underground facilities by hand prior to using power equipment.

California Public Utilities Commission General Order 95

The CPUC General Order, Rule for Overhead Electric Line Construction, formulates uniform requirements for overhead electrical line construction, including overhead catenary construction, the application of which helps provide adequate service and safety for persons engaged in the construction, maintenance, operation, or use of overhead electrical lines and for the public in general.

Water Conservation Act of 2009 (SB X7-7)

The Water Conservation Act of 2009 (SB X7-7, Chapter 4, Statutes of 2009 Seventh Extraordinary Session) requires urban and agricultural water suppliers to increase water use efficiency. The urban water use goal within the state is to achieve a 20 percent reduction in per capita water use by December 31, 2020. Agricultural water suppliers should have prepared and adopted agricultural water management plans by December 31, 2012, were required to update those plans by December 31, 2015, and are required to update those plans every 5 years thereafter. Effective 2013, agricultural water suppliers who do not meet the water management planning requirements established by this bill are not eligible for state water grants or loans.

Clean Energy and Pollution Reduction Act of 2015

The Clean Energy and Pollution Reduction Act of 2015 establishes targets to increase the RPS to 50 percent by 2030 from the retail sales of renewable electricity. The California Energy Commission (CEC) is involved in many efforts to promote and support renewable energy development. These efforts include requiring the state's utilities to disclose their electricity supply portfolio to consumers, funding solar photovoltaic installations on new single-family and multifamily homes, distributing renewable energy conservation planning grants to local governments, providing incentives for the development of geothermal resources, addressing barriers to bioenergy development, and tracking the state's progress toward its renewable goals.

Urban Water Management Planning Act (California Water Code, §§ 10610–10656)

The Urban Water Management Planning Act (California Water Code, Division 6, Part 2.6, §§ 10610–10656) requires the preparation of an urban water management plan every 5 years by water suppliers that provide over 3,000 acre-feet of water annually or serve water for municipal purposes either directly or indirectly to 3,000 or more customers. The SCVWD and water suppliers in urban areas in Santa Clara, San Benito, and Merced Counties including San Jose, Morgan Hill, Gilroy, Hollister, and City of Merced are required to prepare water management plans under the Urban Water Management Planning Act.

Sustainable Groundwater Management Act

California depends on groundwater for a major portion of its annual water supply, and sustainable groundwater management is essential to a reliable and resilient water system. In September 2014, Governor Edmund G. Brown, Jr. enacted the Sustainable Groundwater Management Act (SGMA), which empowers local agencies to adopt groundwater management plans that are tailored to the resources and needs of their communities. The intent of good groundwater management is to provide a buffer against drought and climate change and to contribute to reliable water supplies regardless of weather patterns.

Waste Management for State Agencies (Assembly Bill 75)

This California state law, adopted in 1999, requires each state agency and each large state facility, as defined, to divert at least 50 percent of the waste it generates. Agencies must also designate at least one solid waste reduction and recycling coordinator to oversee the implementation of waste management plans and recycling/reuse programs and submit an annual report, for the prior calendar year, including disposal amounts and explanation of diversion activities. Reports are due by May 1 of each year. The business services manager at the Authority is the designated coordinator.

California Regional Water Quality Management Plans

Division Seven (Water Quality) of the State Water Code establishes the responsibilities and authorities of the nine Regional Water Quality Control Boards (RWQCB) and the SWRCB. The Porter-Cologne Act names these Boards "… the principal State agencies with primary responsibility for the coordination and control of water quality" (Section 13001). Each Regional Board is directed to "… formulate and adopt water quality control plans for all areas within the region." The Regional Boards implement the basin plans by issuing and enforcing waste discharge requirements to individuals, communities, or businesses whose waste discharges can affect water quality. These requirements can be either State Waste Discharge Requirements for discharges to land, or federally delegated National Pollutant Discharge Elimination System (NPDES) permits for discharges to surface water. Methods of treatment are not specified. When such discharges occur, they are managed so that (1) they meet these requirements; (2) water quality objectives are met; and (3) beneficial uses are protected, and water quality is controlled (San Francisco RWQCB 2017; Central Valley RWQCB 2018; Central Coast RWQCB 2019).

3.6.2.3 Regional and Local

Appendix 2-J in Volume 2 provides a list of the regional and local policies relevant to public utilities and energy. These policies include sustainable communities strategies that accompany RTPs, county and city general plans, urban water management plans, and countywide integrated waste management plans. In addition to these plans, a local coalition of the Clean Cities Program has been established within the region.

Clean Cities Program

The U.S. Department of Energy's Clean Cities program was established to advance the nation's economic, environmental, and energy security by supporting local actions to reduce petroleum use in transportation. The Silicon Valley Clean Cities Coalition, in Santa Clara County, builds partnerships with local and statewide organizations in the public and private sectors to advance the use of alternative and renewable fuels, idle-reduction measures, fuel economy improvements, and new transportation technologies (Silicon Valley Clean Cities 2018; U.S. Department of Energy n.d.). In 2017, the City of San Jose established the San Jose Community Energy Department which operates San Jose Clean Energy (SJCE), the City of San Jose's Community Choice Energy (CCE) program. CCEs allow governments to buy electricity for their businesses and residents. The SJCE was launched in September 2018 for City Accounts and in February 2019 for most residents and businesses (City of San Jose 2018a).

3.6.3 Consistency with Plans and Laws

As indicated in Section 3.1.6.3, Consistency with Plans and Laws, CEQA and CEQ regulations require a discussion of inconsistencies or conflicts between a proposed undertaking and federal, state, regional, or local plans and laws. As such, this Final EIR/EIS describes any inconsistency of the project alternatives with federal, state, regional, and local plans and laws to provide planning context.

There are a number of federal and state laws and implementing regulations listed in Section 3.6.2.1, Federal, and Section 3.6.2.2, State, that direct the use of public utilities and energy. A summary of the federal and state requirements considered in this analysis follows:

- Acts and orders applicable to the conservation of petroleum, natural gas, and water include the Power Plan and Industrial Fuel Use Act of 1978; USEO 12185; and the Conservation of Petroleum and Natural Gas, and the Water Conservation Act of 2009.
- Acts and orders applicable to the safe transmission of hazardous material, natural gas, oil, and electricity include Norman Y. Mineta and Special Programs Improvement Act and the FERC. The RCRA provides for the proper management of solid and hazardous wastes, from their generation to ultimate disposal or destruction.
- Federal and state initiatives to reduce energy consumed and GHG emissions from motor vehicles include CAFE, California vehicle efficiency regulations (see Section 3.3, Air Quality), and Sustainable Communities and Climate Protection Act of 2008.
- The Public Utilities Code regulates public electric utilities in California. California Code of Regulations (California Code of Regulations), Title 24, Part 6, & Part 11, Energy Efficiency Standards promotes efficient energy use in new buildings constructed in California.
- The Integrated Waste Management Act regulates generation and disposal of waste in California and mandates a reduction of waste being disposed. The Local Government Construction and Demolition Guide assists jurisdictions with diverting their C&D material, with a primary focus on CalRecycle.
- The RPS Program requires retail sellers of electricity in California to increase their purchases of electricity generated by renewable sources.
- Prior to excavation of any subsurface installation in California, the excavator must contact a regional notification center per the Protection of Underground Infrastructure.
- CPUC General Order 176 and General Order 95 regulate overhead electric line construction in California.

The Authority, as the lead agency proposing to construct and operate the HSR system, must comply with all federal and state laws and regulations, and secure all applicable federal and state permits prior to initiating construction on the selected alternative. Therefore, there would be no inconsistencies between the project alternatives and these federal and state laws and regulations.

The Authority is a state agency and therefore is not required to comply with local land use and zoning regulations; however, the Authority has endeavored to design and construct the HSR project so that it is consistent with land use regulations. For example, the project alternatives will incorporate IAMFs to minimize impacts on public utilities and energy. Analysts reviewed a total of 21 regional and local plans including 69 goals, policies, and objectives (listed in Volume 2, Appendix 2-J), and determined, based on comparison of the project to the policies, goals, and objectives reviewed, that there would be no inconsistencies.

3.6.4 Methods for Evaluating Impacts

The National Environmental Policy Act (NEPA) and CEQA require evaluation of impacts on public utilities and energy. The following sections define the RSAs and summarize the methods used to analyze impacts on public utilities and energy. As summarized in Section 3.6.1, Introduction, six other resource sections in this Final EIR/EIS also provide additional information related to public utilities and energy.

3.6.4.1 Definition of Resource Study Area

As defined in Section 3.1, Introduction, RSAs are the geographic boundaries in which analysts conducted the environmental investigations specific to each resource topic. There are two RSAs for public utilities and energy, one for public utilities and one for energy resources. The RSA for impacts on public utilities and the RSA for impacts on energy resources encompass the infrastructure and service areas of public utilities and energy sources, respectively, that construction and operation of the project could directly and indirectly affect. The RSA for direct

impacts includes the entire project footprint on or across public utilities and energy infrastructure, including surface, subsurface, and overhead utilities. The RSA for indirect impacts includes the area that would extend beyond the project footprint, including areas where utility relocations, use of non-HSR utility and energy resources and facilities necessary for project construction and operation, and construction of electrical interconnections with local utilities would occur. Table 3.6-1 describes specific RSA boundaries for public utilities and energy resources.

Table 3.6-1 Definition of Public Utilities and Energy Resource Study Areas

Type	Boundary Definition
Public Utilities	
Utility-owned properties and facilities including major public utility infrastructure and facilities required for connecting to the HSR system. Facilities include substations; easements; overhead utility lines (e.g., electricity, telephone, cable television); and buried utility lines (e.g., electricity, water, wastewater, stormwater, natural gas lines, petroleum product lines).	The RSA for direct impacts includes the entire project footprint on or across public utilities and energy infrastructure, including surface, subsurface, and overhead utilities, which include stormwater and water supply lines, electricity transmission facilities, natural gas and petroleum product pipelines, fiber optics, and communication facilities. The RSA for indirect impacts includes the area that would extend beyond the project footprint, including impacts of utility relocations or use of non-HSR resources and facilities necessary for project construction and operation, and construction of electrical interconnections with local utilities required for connecting to the HSR system.
Wastewater Treatment Facilities	Santa Clara County, Merced County, City of Santa Clara, City of San Jose, City of Morgan Hill, City of Gilroy, City of Los Banos, Santa Nella
Stormwater Management Facilities	Santa Clara County, Merced County, City of Santa Clara, City of San Jose, City of Morgan Hill, City of Gilroy, City of Los Banos, Santa Nella
Solid Waste Management Facilities	Santa Clara County, San Benito County, Merced County, City of Santa Clara, City of San Jose
Hazardous Waste Management Facilities[1]	Kings County, Kern County, Imperial County
Energy Resources	
Electricity generation and transmission systems required for connecting to the HSR system, as well as changes in petroleum consumption for vehicle and plane travel and electrical, natural gas, and petroleum consumption demands from construction and operation of the HSR and its associated facilities.	Infrastructure and service areas of energy resource providers. Includes the project footprint and areas within and beyond the project footprint, including the electricity grid in the entire state of California and other western states that produce energy exported to California.[2]

RSA = resource study area
HSR = high-speed rail
[1] There are no licensed hazardous waste disposal facilities in Santa Clara, San Benito, or Merced Counties. There are three licensed hazardous waste disposal facilities in California, one in Kern County, one in Kings County, and one in Imperial County.
[2] The HSR system would obtain electricity from the statewide grid. Therefore, this analysis cannot apportion to a particular regional study area the use of any particular generation facilities.

3.6.4.2 Impact Avoidance and Minimization Features

IAMFs are project features that are considered to be part of the project and are included as applicable in each of the alternatives for purposes of the environmental impact analysis. The full text of the IAMFs that are applicable to the project is provided in Appendix 2-E. The following IAMFs are applicable to the public utilities and energy analysis:

- PUE-IAMF#1: Design Measures
- PUE-IAMF#2: Irrigation Facility Relocation
- PUE-IAMF#3: Public Notifications
- PUE-IAMF#4: Utilities and Energy
- SS-IAMF#2: Safety and Security Management Plan
- HYD-IAMF#1: Storm Water Management
- HYD-IAMF#3: Prepare and Implement a Construction Stormwater Pollution Prevention Plan
- GEO-IAMF#1: Geologic Hazards
- BIO-IAMF#1: Project Biologist
- HMW-IAMF#5: Demolition Plans
- GEO-IAMF#10: Geology and Soils
- HMW-IAMF#7: Transport of Materials
- HMW-IAMF#8: Permit Conditions
- HMW-IAMF#10: Hazardous Materials Plans
- HYD-IAMF#2: Flood Protection
- HYD-IAMF#4: Prepare and Implement an Industrial Stormwater Pollution Prevention Plan

This environmental impact analysis considers these IAMFs as part of the project design. Within Section 3.6.6, Environmental Consequences, each impact narrative describes how these project features are applicable and, where appropriate, effective at avoiding or minimizing impact to less than significant under CEQA.

3.6.4.3 Methods for Impact Analysis

Overview of Impact Analysis

This section describes the sources and methods used to analyze potential project impacts on public utilities and energy. These methods apply to both NEPA and CEQA analyses unless otherwise indicated. Refer to Section 3.1.6.4, Methods for Evaluating Impacts, for a description of the general framework for evaluating impacts under NEPA and CEQA. Sections 3.6.4.4, Method for Evaluating Impacts under NEPA, and 3.6.4.5, Method for Determining Significance under CEQA, describe the NEPA and CEQA impact methodologies used to evaluate project impacts on public utilities and energy.

Public Utilities

The public utilities section assesses the impact that construction of the project would have on public utilities in the RSA and the ability of public utility providers and facilities to meet new demand for utility services, such as electricity, water, wastewater, and solid waste disposal, resulting from construction and operation of the project.

Public Utilities Analysis Evaluates:

- Planned and accidental utility service interruptions during construction
- Temporary and permanent conflicts with existing utility lines within the RSA
- Demand for utility services for construction and operation, including water, wastewater, stormwater, and solid waste

Construction Impacts

The Authority has engaged at the local level with public utility operators and local agencies since 2009 to identify public utilities in the RSA and to conduct early coordination to minimize potential utility conflicts. Analysts reviewed utility corridor maps, as-built drawings, and encroachment requirements provided by utility providers to determine the type, size, and location of existing utility infrastructure within the public utilities

RSA. Specialists mapped the locations of public utilities, including natural gas, petroleum and fuel pipelines, electric transmission lines, water lines, wastewater and stormwater management lines, and communications facilities in the public utility RSA, using geographic information systems. Analysts then quantified impacts on major utilities (defined in Section 3.6.1, Introduction) by counting each time the utility would cross the project alternatives and determined whether the conflicting utilities would require relocation or could be protected in place. Volume 2, Appendix 3.6-A, provides information on the individual utility conflicts in the public utilities RSA.

Analysts estimated construction water use for the project based on the amount of water that would be used during construction for operation of concrete batch plants for production of concrete, placement of concrete, earthwork, dust control, landscaping, and operation of tunnel boring machines (TBM). Analysts developed estimates for construction water use based on assumptions for the amount of required concrete and number of water trucks included in the on-site vehicle construction schedule for each alternative (Tung 2017; Authority 2018a). Estimates of existing water use in the RSA used region-specific water use rates for the known land uses in the RSA. Volume 2, Appendix 3.6-C provides additional discussion of the methodology and analysis prepared as part of the water use assessment. Section 3.8, Hydrology and Water Resources, provides additional detail regarding surface and groundwater supplies and quality, stormwater management, and hydrology.

The Authority's engineers provided estimates of the amount of vegetation clearing, removal of existing asphalt and gravel, and demolition of existing structures to calculate the amount of solid waste generated by C&D activities. These estimates took into consideration the existing characteristics of the public utilities RSA including the approximate square footage of structures that would be demolished for construction of the project, the amount of cut-and-fill profile, and the materials generated by the operation of TBMs.

Operations Impacts

Analysts estimated operational potable and nonpotable water consumption and solid waste generation based on the new station facilities and the operations and maintenance activities at the maintenance of way siding (MOWS) and maintenance of way facility (MOWF) based on typical rates. Analysts assumed wastewater generation for operation of the HSR stations and maintenance facilities to be 100 percent of total water demand during operation. The amount of wastewater to be generated by operation of the project would actually be lower than the water demand because not all operational uses of water would generate wastewater (e.g., irrigation). At this time, the amount of wastewater that would be generated by operation is not known, so to be conservative this analysis uses the assumption that wastewater would equal 100 percent of the total water demand.

To evaluate the potential need for construction of new water supply or wastewater or waste management infrastructure, analysts compared the water consumption, wastewater generation, and solid and hazardous waste generation estimates to the anticipated water supply and wastewater and solid and hazardous waste disposal capacity.

Energy

As described in Section 3.6.1, Introduction, transportation energy is generally discussed in terms of direct and indirect energy. Energy impacts caused by the project would comprise the additional consumption of electricity to power the HSR system (direct use) and consumption of resources to construct the proposed HSR facilities (indirect use).

Energy Resources Analysis Evaluates:

- Construction energy demand
- Peak electricity demand during construction
- Operation energy demand
- Peak electricity demand during operation
- Regional and statewide energy consumption for transportation modes
- Ancillary energy consumption for operations

Construction Impacts

Indirect energy consumption involves the nonrecoverable, one-time energy expenditure required to construct the physical infrastructure associated with the project alternatives. Analysts estimated construction energy use for the project based on the amount of fuel used for construction vehicles and helicopters and the amount of electricity used at construction sites. Energy would be used during construction for lighting and communications, operation of construction vehicles and equipment for structural work, placement of concrete, earthwork, dust control, landscaping, and operation of TBMs. Energy would also be used during construction for operation of helicopters for reconductoring electric transmission lines to provide electric power to the project alternatives.

This analysis uses construction energy data from other sources or existing HSR systems, because construction energy consumption information for comparable HSR systems is not readily available. Therefore, construction-related energy consumption factors identified for the HSR system include applicable construction data gathered for typical heavy-rail systems and the San Francisco Bay Area Rapid Transit District (BART) heavy-rail commuter system. Analysts used these data to estimate construction-related energy consumption for the project alternatives. Analysts then compared the electricity demand for construction (calculated in terms of megawatt hours and Btus) to current estimates of peak demand and supply capacity within the electricity distribution grid controlled by the California Independent System Operator (Cal-ISO).

Operations Impacts

The project and the proposed HSR system would obtain electricity from the statewide electricity grid. To identify the projected energy demand of the project, the estimated electrical requirements of the HSR system were prorated based on the proportion of the length of HSR guideway in the project extent. Phase 1 of the HSR system would be approximately 520 miles long. The length of the project is approximately 90 miles, or approximately 17 percent of the full HSR system, and consequently would consume approximately 17 percent of the electrical requirements of the HSR system.

In calculating estimated energy savings for operations of the project alternatives, two ridership probability scenarios were used: medium and high. These scenarios are based on probabilistic estimates for Phase I of the HSR system to achieve its ridership projections by 2040. In the case of HSR, *probabilistic* is defined as numerous possible ridership outcomes, each having varying degrees of certainty or uncertainty of occurring. More detailed discussions of travel demand and ridership forecasts are presented in Sections 2.7.1, Travel Demand and Ridership Forecasts, and 3.1.6.6, Environmental Consequences.

Energy used for vehicle propulsion is a function of traffic characteristics and the thermal value of the fuel used. Analysts derived petroleum consumption rates for vehicle travel from the travel demand forecast for the HSR and growth projections performed by the CEC. These consumption rates were used to determine the amount of petroleum used for transportation under the No Project Alternative and the project alternatives. Analysts then compared current electricity consumption rates from the CEC with the projected energy consumption of the HSR system. Refer to Volume 2, Appendix 3.6-D, for additional information regarding the methodology for determining projected energy consumption of the HSR system.

The construction energy payback period measures the number of years required to pay back the energy used in construction with operational energy consumption savings of the project alternatives. Analysts calculated the payback period by dividing the estimated HSR system construction energy by the amount of energy that the HSR system would later save (based on the prorated statewide value). The calculations assume that the amount of energy saved in the study years (2015 and 2040) would remain constant throughout the payback period.

3.6.4.4 Method for Evaluating Impacts under NEPA

CEQ NEPA regulations (40 C.F.R. Parts 1500–1508) provide the basis for evaluating project effects (as described in Section 3.1.6.4). As described in Section 1508.27 of these regulations, the criteria of context and intensity are considered together when determining the severity of the change introduced by the project.

- **Context—**For this analysis, the context for the proposed project's effect on public utilities and energy would include the following:
  - The regulatory setting pertaining to public utilities and, including CAFE standards, regulations set by the FERC and the CPUC, local utility and energy-related ordinances and standards, and integrated waste management plans
  - The regional and local regulatory setting pertaining to energy, including regional, county, and municipal general plans, transportation plans, renewable energy standards, and local GHG emissions management plans and policies
  - The statewide electricity generation and distribution system that would provide electricity for construction and operation of the HSR system
  - The number of users and importance of various modes of the transportation system, including vehicle (automobile and bus) and airplane transportation
  - The utility system, the relationship to project alternatives, and the number of potential disruptions by the HSR
- **Intensity—**This analysis determines intensity by assessing the following:
  - The project's effect on demand for public utility services and energy
  - Any potential violation by the project of federal, state, or local law or requirements imposed for the protection of the environment
  - The degree to which possible effects related to public utilities and energy are uncertain or involve unknown risks, which could occur if the project would result in an exceedance of existing and planned capacity of public utilities and energy providers

3.6.4.5 Method for Determining Significance under CEQA

CEQA requires an EIR to identify the significant environmental impacts of a project (CEQA Guidelines § 15126). One of the primary differences between NEPA and CEQA is that CEQA requires a threshold-based impact analysis. Significant impacts are determined by evaluating whether project impacts would exceed the significance threshold established for the resource (as presented in Section 3.1.6.4). By contrast, under NEPA, significance is used to determine whether an EIS will be required; NEPA requires a federal lead agency to prepare an EIS when the proposed federal action (project) as a whole has the potential to "significantly affect the quality of the human environment." Accordingly, Section 3.6.9, CEQA Significance Conclusions, summarizes the significance of the environmental impacts on public utilities and energy for each project alternative.

The Authority is using the following thresholds to determine if a significant impact on public utilities and energy would occur as a result of the project alternatives. For the CEQA analysis, the project would result in a significant impact on public utilities if it would:

- Require or result in the relocation or construction of new or expanded water, wastewater treatment, or stormwater drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects
- Have insufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry, and multiple dry years
- Result in a determination by the wastewater treatment provider that serves or may serve the project that it has inadequate capacity to serve the project's projected demand in addition to the provider's existing commitments
- Generate solid waste in excess of state or local standards, or in excess of the capacity of local infrastructure or otherwise impair the attainment of solid waste reduction goals
- Fail to comply with federal, state, and local management and reduction statutes and regulations related to solid waste

Low-impact conflicts would occur if the project would cross or conflict with distribution pipelines or electrical power lines, which are easier to avoid, relocate, or protect in place. Low-impact conflicts involving utilities are considered less than significant impacts on utilities and service systems because these types of utilities and service systems would be temporarily affected, typically only during a brief relocation period. Construction work that could result in temporary interruption of utility services would be conducted in coordination with the utility provider and with prior public notification, and utility service levels would remain unchanged after construction work is completed. Environmental consequences related to utility relocations are described in detail in Section 3.6.6, Environmental Consequences.

For purposes of analysis for this Final EIR/EIS, the Authority is using the following additional criteria as thresholds of significance. For this analysis, the project would result in a significant impact on public utilities and energy if it would:

- Require or result in the construction of new electrical facilities or expansion and upgrade of existing facilities, the construction of which could cause significant environmental effects
- Conflict with a major nonlinear fixed facility, such as an electrical substation or wastewater treatment plant (WWTP), the relocation of which could cause a lengthy and harmful interruption of service
- Conflict with a major linear non-fixed facility, such as major stormwater transmission main or gas/electricity transmission facility, the reconstruction or relocation of which could cause a lengthy and harmful interruption of service

According to Appendix F of the CEQA Guidelines, EIRs must discuss the potential energy impacts of proposed projects, with particular emphasis on avoiding or reducing inefficient, wasteful, and unnecessary consumption of energy. Wise and efficient use of energy may include decreasing overall per capita energy consumption; decreasing reliance on fossil fuels such as coal, natural gas, and oil; and increasing reliance on renewable energy sources. The significance criteria discussed herein are used to determine whether the project would have a potentially significant effect on energy use, including energy conservation:

- Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation
- Conflict with or obstruct a state or local plan for renewable energy or energy efficiency
- Place a substantial demand on regional energy supply or require substantial additional capacity or substantially increase peak and base period electricity demand

By contrast, if the proposed project results in energy savings, alleviates demand on energy resources, or encourages the use of efficient transportation alternatives, it would have a beneficial effect.

3.6.5 Affected Environment

This section describes the affected environment for public utilities and energy in their RSAs, including the existing public utilities and energy providers and infrastructure, and energy sources, supply, demand, and transmission. This information provides the context for the environmental analysis and evaluation of impacts.

Table 3.6-2 provides a summary of the utility and energy providers within the public utilities RSA. Table 3.6-2 includes public utilities and energy providers that are categorized as major utilities and identified in Appendix 3.6-A and also includes public utilities and energy providers within the RSA that are not categorized as major utilities but that provide utility and energy services within the RSA. The subsequent text and figures focus on the major public utilities within the RSA, including facilities for electricity, natural gas, petroleum, potable water, stormwater, wastewater, and solid waste.

Table 3.6-2 Summary of Utility and Energy Providers within the Resource Study Areas[1]

Utility Type		County/City Location	Provider
Electrical		Santa Clara, San Benito, and Merced Counties	PG&E
		City of Santa Clara	Silicon Valley Power
		Cities of San Jose and Gilroy	Calpine
Natural Gas		Santa Clara, San Benito, and Merced Counties	PG&E
		Santa Clara County	CPN Pipeline Co.
			Silicon Valley Power
Petroleum and Fuel Pipelines		Merced County[2]	Shell
			Phillips 66
			Chevron
Communications	Telephone	Santa Clara, San Benito, and Merced Counties	AT&T
			Verizon
		Santa Clara County	T-Mobile
			Sprint
			Century Link/Level 3 Communications
			Century Link/QWEST
		San Benito County	T-Mobile
			Charter Spectrum
		Merced County	T-Mobile
			Comcast
	Cable/Internet	Santa Clara, San Benito, and Merced Counties	AT&T
			Verizon
			Comcast/Xfinity

Utility Type		County/City Location	Provider
		Santa Clara County	CenturyLink/Level 3 Communications
		San Benito County	Charter Spectrum
		Merced County	Comcast/Xfinity
			CenturyLink/Level 3 Communications
Water Supply	Potable	Santa Clara County	Santa Clara Valley Water District
		City of Santa Clara	City of Santa Clara Water Utility
		City of San Jose	San Jose Water Company
			Great Oaks Water Company
			San Jose Municipal Water System
		City of Morgan Hill	City of Morgan Hill Water Division
		City of Gilroy	City of Gilroy Public Works
		San Benito County	San Benito County Water District
		Merced County	U.S. Department of the Interior, Bureau of Reclamation[3]
			San Luis and Delta-Mendota Water Authority[3]
			California Department of Water Resources[4]
			Henry Miller Reclamation District/San Luis Canal Company
			San Luis Water District
			Central California Irrigation District
		Santa Nella	Santa Nella County Water District
		Volta	Volta Community Services District
		City of Los Banos	City of Los Banos Public Works
	Recycled	Cities of Santa Clara and San Jose	South Bay Water Recycling System
		City of Gilroy	South County Regional Water Authority
	Agricultural[5]	Santa Clara County	Santa Clara Valley Water District
		San Benito County	San Benito County Water District
		Merced County	U.S. Department of the Interior, Bureau of Reclamation
			San Luis and Delta-Mendota Water Authority
			California Department of Water Resources
			Henry Miller Reclamation District/San Luis Canal Company
			Grassland Water District
			Central California Irrigation District
			San Luis Water District

Utility Type	County/City Location	Provider
		Del Puerto Water District
		Centinella Water District [6]
Wastewater Collection and Treatment	Santa Clara County	Municipal service providers; on-site wastewater treatment systems in unincorporated areas
	City of Santa Clara	City of Santa Clara Sewer Utility
		San Jose/Santa Clara Regional Wastewater Facility
	City of San Jose	City of San Jose Environmental Services Department
		San Jose/Santa Clara Regional Wastewater Facility
	City of Morgan Hill	City of Morgan Hill Department of Public Works
	City of Gilroy	City of Gilroy Water Department
	City of Gilroy	South County Regional Wastewater Authority
	San Benito County	San Benito County Resource Management Agency; municipal service providers; on-site treatment systems in unincorporated areas
	Merced County	Merced County Public Works; municipal service providers; on-site treatment systems in unincorporated areas
	Santa Nella	Santa Nella County Water District
	City of Los Banos	City of Los Banos Public Works
Stormwater Management	Santa Clara County	Santa Clara County Roads and Airports Department (unincorporated areas); municipal service providers
	Santa Clara County	Santa Clara County Clean Water Program
	City of Santa Clara	City of Santa Clara Public Works
	City of San Jose	City of San Jose Department of Transportation
	City of Morgan Hill	City of Morgan Hill Utilities
	City of Gilroy	City of Gilroy Public Works
	San Benito County	San Benito County Resource Management Agency; municipal service providers
	Merced County	Merced County Department of Public Works
	Santa Nella	Santa Nella County Water District
	City of Los Banos	City of Los Banos Public Works
Solid Waste Disposal	Santa Clara County	Kirby Canyon Recycling and Disposal Facility
		Guadalupe Community Facility
		Newby Island Sanitary Landfill
	San Benito County	John Smith Road Class III Landfill
	Merced County	Billy Wright Landfill
		Highway 59 Landfill

Sources: AT&T 2018; Reclamation and DWR 2003; Reclamation 2013, 2014; Reclamation and SLDMWA 2014; CalRecycle 2019a, 2019b, 2019c, 2019d, 2019e; 2019f; Calpine 2017a, 2017b, 2017c, 2017d, 2017e; Charter Spectrum 2017; City of Gilroy 2016a; City of Morgan Hill 2016a, 2017a; City of Los Banos 2010; City of Santa Clara 2018a, 2018b; City of San Jose 2018b; CCID 2014a, 2017; Del Puerto Water District 2011; Nolte 2009; County of San Benito 2010, 2018; County of Santa Clara 2018a; Santa Nella County Water District 2017a; SLWD 2012; SLDMWA 2018; SVP 2017.
[1] Table 3.6-2 includes public utilities and energy providers that are categorized as major utilities and identified in Appendix 3.6-A and also includes public utilities and energy providers within the RSA that are not categorized as major utilities; non-major utilities are not identified in Appendix 3.6-A.
[2] No major utility petroleum or fuel pipelines have been identified in the Union Pacific Railroad right-of-way in Santa Clara County or San Benito County.
[3] The Delta-Mendota Canal is owned by the U.S. Department of the Interior, Bureau of Reclamation and is operated by the San Luis and Delta-Mendota Water Authority on behalf of the U.S. Department of the Interior, Bureau of Reclamation pursuant to an operation and maintenance agreement. The Delta-Mendota Canal is part of the Central Valley Project.
[4] The California Department of Water Resources is the operator of the California Aqueduct, which is part of the State Water Project.
[5] Includes local maintaining agencies within the public utilities and energy resource study area.
[6] The Centinella Water District sold its entire allocation of water from the U.S. Department of the Interior, Bureau of Reclamation and currently has no water allocation for distribution. The Centinella Water District Manager is investigating procedures for dissolving the Water District.
PG&E = Pacific Gas and Electric Company

3.6.5.1 Public Utilities

Major public utilities within the public utility RSA include facilities for electricity, natural gas and petroleum distribution, water supply infrastructure (potable, recycled, and agricultural water), stormwater management structures including storm drains and canals, and sanitary sewer lines. Table 3.6-3 provides a summary by alternative and subsection of the major utilities within the public utility RSA for each project alternative.

Table 3.6-3 Major Utility Lines within the Public Utility Resource Study Area

Alternative/Subsection	Electrical Lines	Transmission Tower	Natural Gas	Petroleum Pipelines	Communication Lines	Storm/Wastewater Pump Station	Storm Drains and Canals	Sanitary Sewers	Potable/Recycled Water
Alternative 1									
San Jose Diridon Station Approach	1	2	0	0	10	0	0	1	1
Monterey Corridor	3	0	2	0	15	0	4	5	2
Morgan Hill and Gilroy	59	1	8	0	36	0	2	1	16
Pacheco Pass	17	0	0	1	1	0	2	0	1
San Joaquin Valley	23	0	0	1	10	2	70	0	0
Alternative 1 Totals	**103**	**3**	**10**	**2**	**72**	**2**	**78**	**7**	**20**
Alternative 2									
San Jose Diridon Station Approach	1	2	0	0	10	0	0	1	1
Monterey Corridor	5	0	3	0	23	6	5	9	2
Morgan Hill and Gilroy	60	4	6	0	96	25	4	5	6
Pacheco Pass	17	0	0	1	1	0	2	0	1
San Joaquin Valley	23	0	0	1	10	2	70	0	0
Alternative 2 Totals	**106**	**6**	**9**	**2**	**140**	**33**	**81**	**15**	**10**
Alternative 3									
San Jose Diridon Station Approach	1	2	0	0	10	0	0	1	1

Alternative/Subsection	Electrical Lines	Transmission Tower	Natural Gas	Petroleum Pipelines	Communication Lines	Storm/Wastewater Pump Station	Storm Drains and Canals	Sanitary Sewers	Potable//Recycled Water
Monterey Corridor	3	0	2	0	15	0	4	5	2
Morgan Hill and Gilroy	53	0	10	0	28	0	0	0	7
Pacheco Pass	17	0	0	1	1	0	2	0	1
San Joaquin Valley	23	0	0	1	10	2	70	0	0
Alternative 3 Totals	**97**	**2**	**12**	**2**	**64**	**2**	**76**	**6**	**11**
Alternative 4									
San Jose Diridon Station Approach	34	1	6	2	29	4	19	13	14
Monterey Corridor	7	0	1	0	11	1	5	5	2
Morgan Hill and Gilroy	59	0	6	0	36	9	6	5	19
Pacheco Pass	17	0	0	1	1	0	2	0	1
San Joaquin Valley	23	0	0	1	10	2	70	0	0
Alternative 4 Totals	**140**	**1**	**13**	**4**	**87**	**16**	**102**	**23**	**36**

Facilities that were identified as both electrical and telecommunication facilities were included in counts for each type.

Electrical Transmission

PG&E provides electricity to much of Northern California, from approximately Bakersfield to the California-Oregon border. The company's generation portfolio includes hydroelectric facilities, a nuclear power plant, and a natural gas-fired power plant. PG&E provides electric service to most of the RSA. It generates electricity in facilities within several hundred miles of the points of use (PG&E 2014; CEC 2017a). Silicon Valley Power (SVP), a municipal-owner utility, operates electrical generating equipment and provides electricity service to the City of Santa Clara (SVP 2017). Calpine operates electric generation equipment in San Jose and Gilroy (Calpine 2017a, 2017b, 2017c, 2017d, 2017e).

Figure 3.6-1 illustrates the locations of major utility electrical transmission and power lines (≥ 50 kV) within the public utilities RSA (identified by alternative and by subsection in Table 3.6-3). Most major electrical transmission lines within the public utilities RSA are PG&E transmission lines, which occur in all subsections of the public utilities RSA, with most in the Morgan Hill and Gilroy Subsection. SVP owns and operates a 6-mile 230-kV electric transmission line and a 0.25-mile 115-kV electric transmission line within the public utilities RSA that provide electric power to the City of Santa Clara (NERC 2012). Calpine operates five facilities in Santa Clara County: the Los Esteros Critical Energy Facility, Metcalf Energy Center, and Agnews Power Plant in San Jose, and the Gilroy Energy Center and Gilroy Cogeneration Facility in Gilroy. The Calpine Esteros Facility is a 243-megawatt (MW) natural gas combined cycle electric generation facility. The Metcalf Energy Center is a 564-MW natural gas combined cycle electric generation facility. The Agnews Power Plant is a 28-MW natural combined cycle electric generation facility. The Esteros, Metcalf, and Agnews facilities use recycled water provided by the City of San Jose (Calpine 2017a, 2017b, 2017c). The Gilroy Energy Center is a 141-MW natural gas turbine electric generation facility. The Gilroy Cogeneration Facility is a 130-MW natural gas steam-electric generation facility that generates both steam and electricity. The steam generated is sold to an

adjacent food processing facility. The two Gilroy facilities use recycled water provided by the South County Regional Wastewater Authority (SCRWA) (Calpine 2017d, 2017e).

Major electrical facilities in the public utilities RSA also include PG&E electric transmission towers and PG&E electrical substations. Two electric transmission towers are within the San Jose Diridon Station Approach Subsection of the public utilities RSA for all alternatives, while a third electric transmission tower is within the RSA for Alternatives 1 and 2 in the Morgan Hill and Gilroy Subsection. There are three existing electrical substations within the RSA—the Metcalf Substation (150 Metcalf Road, San Jose, CA 95138), the Morgan Hill Substation (330 West Main Avenue, Morgan Hill, CA 95037), and the Llagas Substation (601 Renz Lane, Gilroy, CA 95020). Electrical transmission lines parallel to the proposed HSR alignments extend between these electrical substations. Quinto Solar photovoltaic facility in Los Banos (Merced County) is a 108-MW solar generating facility owned and operated by 8 Point 3 Energy Partners that commenced operation in 2015. The facility sells electric power to Southern California Edison (SunPower 2014; Westside Connect 2015).

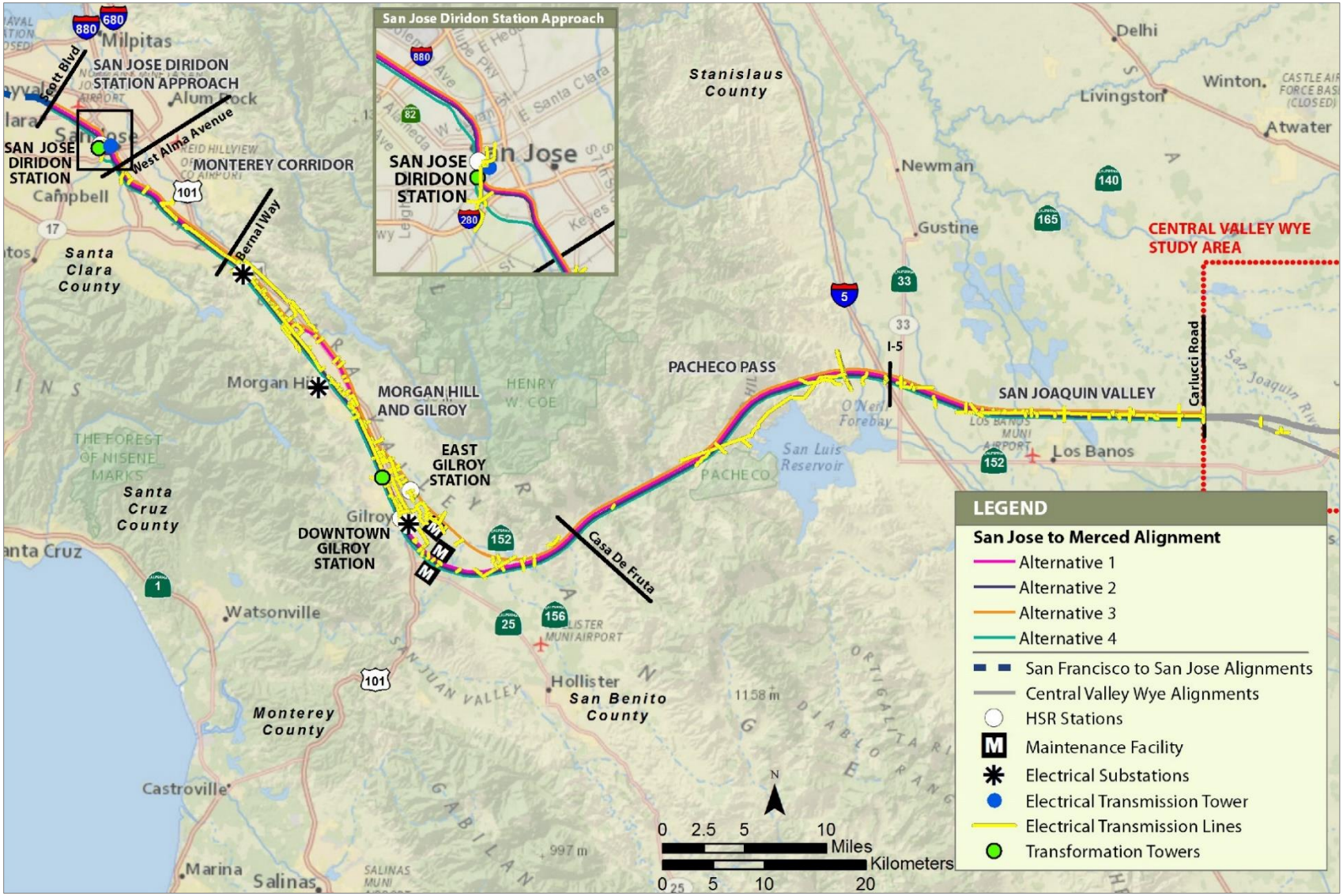
High-Pressure Natural Gas Pipelines

PG&E is the primary natural gas service provider for the region and is responsible for maintaining the infrastructure for natural gas distribution in Santa Clara, San Benito, and Merced Counties (CEC 2017a). Other high-pressure natural gas pipeline operators in Santa Clara County include the CPN Pipeline Company, which operates a 16-inch natural gas pipeline to supply natural gas to Calpine electric generating equipment in San Jose, and SVP, which operates a 16-inch natural gas pipeline to supply natural gas to SVP generating facilities in Santa Clara. High-pressure natural gas distribution lines generally follow existing transportation corridors (e.g., roads and railroad tracks).

Figure 3.6-2 illustrates major utility natural gas pipelines within the public utilities RSA. Table 3.6-3 provides a summary of major utility natural gas pipelines that cross or run parallel to the project alternatives. Three major utility high-pressure 34-inch diameter natural gas pipelines owned by PG&E cross or run parallel to and within the alignment for Alternatives 1, 3, and 4 in the Morgan Hill and Gilroy Subsection and two 34-inch diameter major utility natural gas pipelines cross the alignment for Alternative 2. These pipelines cross the alignments at more than one location; each location at which the pipelines cross or run parallel to and within the alignment are identified as separate and distinct major utility conflicts in the utility conflicts summary. No major utility natural gas pipelines cross the alignment for any alternative in the San Jose Diridon Station Approach, Pacheco Pass, or San Joaquin Valley Subsections.

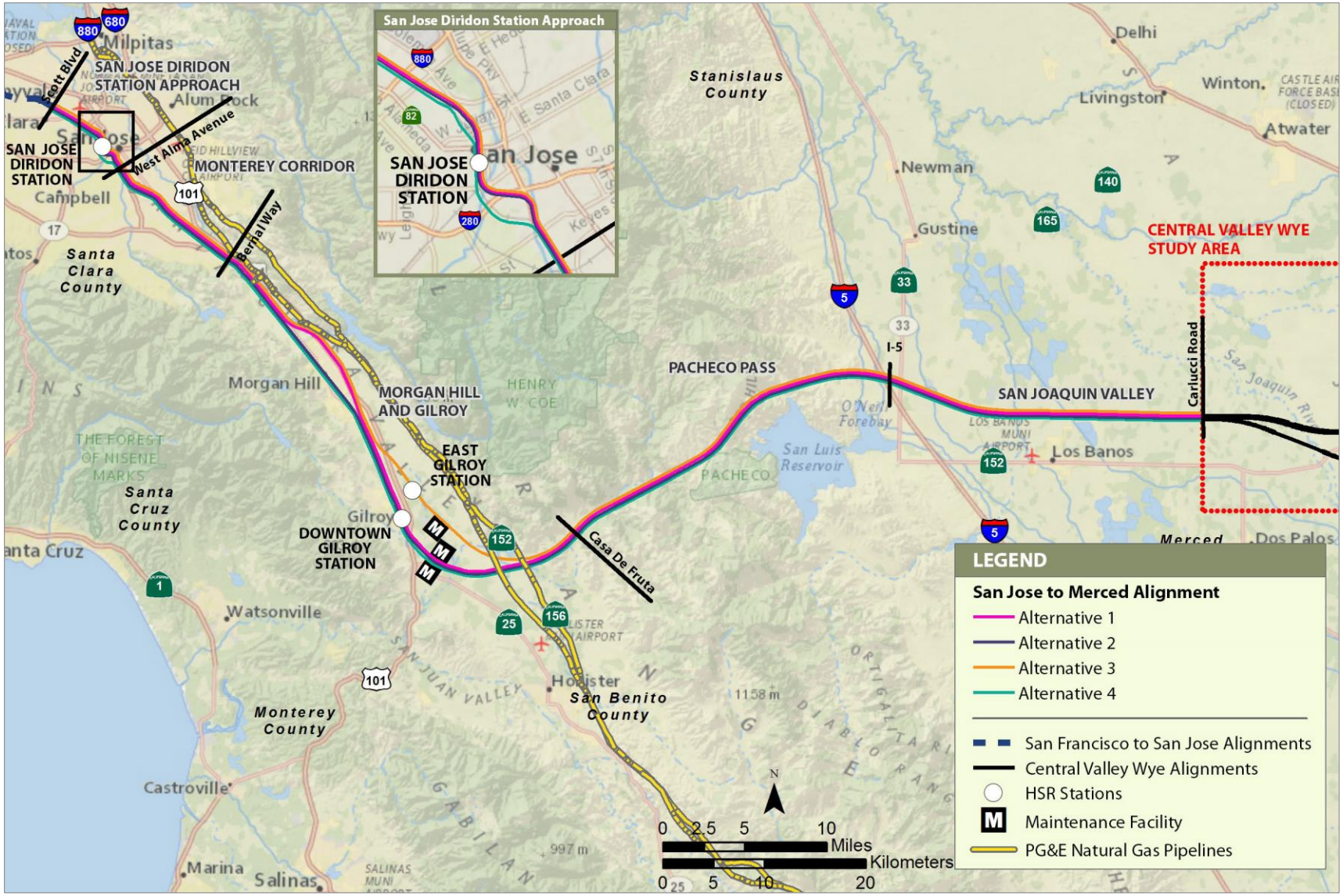
Petroleum and Fuel Pipelines

Petroleum and fuel pipelines transport a variety of products including crude oil, gasoline, jet fuel, home heating oil, and diesel fuel. Although there are three petroleum and fuel pipeline providers in the public utilities RSA—Shell, Phillips 66, and Chevron—only one major utility crude oil pipeline (20-inch outside diameter) operated by Shell oil company crosses the alignment for all project alternatives. This pipeline is approximately parallel to Interstate (I-) 5 in the Pacheco Pass Subsection (approximately 0.5 mile west of the California Aqueduct) and is illustrated on Figure 3.6-3.



AUGUST 2019

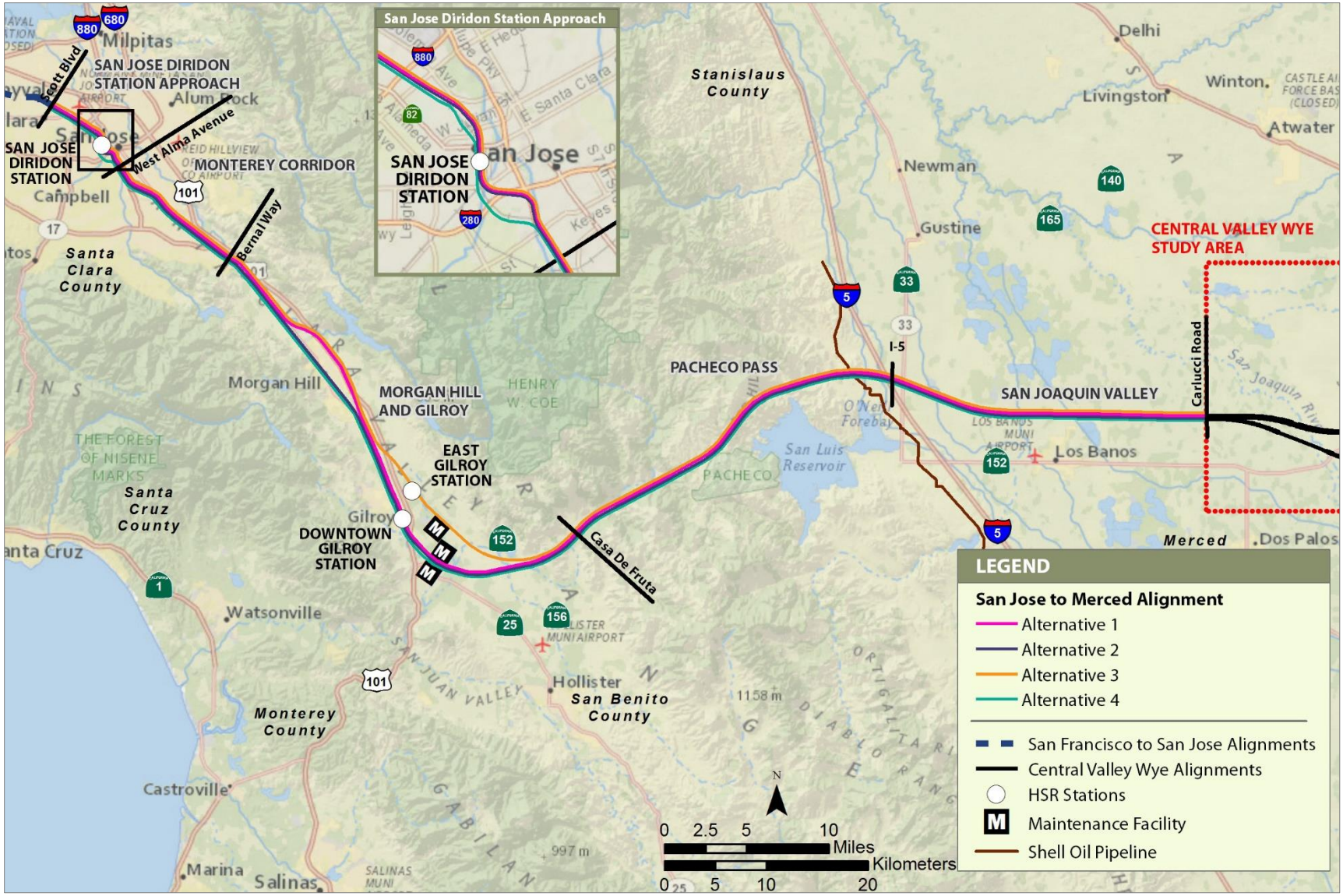
Figure 3.6-1 Electric Transmission Lines, Power Lines, and Substations in the Resource Study Area



Source: USDOT 2017

JANUARY 2019

Figure 3.6-2 Major Natural Gas Pipelines in the Resource Study Area



Source: USDOT 2017

AUGUST 2019

Figure 3.6-3 Major Petroleum Pipelines in the Resource Study Area

Communication Facilities

Communications service providers in Santa Clara, San Benito, and Merced Counties are shown in Table 3.6-2. Appendix 3.6-A in Volume 2 includes a summary of major communications lines that either run parallel to or cross the proposed HSR alignments.

Santa Clara County

AT&T and Verizon are the primary telecommunications service providers in the public utilities RSA in Santa Clara County. Other utility providers in Santa Clara County (e.g., Sprint, Century Link/QWEST, Century Link/Level 3 Communications, T-Mobile, Comcast) operating in Santa Clara County own or lease cell towers and telecommunications lines (cable and telephone). Components of the infrastructure are aboveground and below-ground and are generally within the Union Pacific Railroad, Monterey Road, and U.S. Highway (US) 101 rights-of-way and in urban areas between San Jose and Gilroy.

San Benito County

AT&T and Verizon are the primary telecommunications service providers in the public utilities RSA in San Benito County. Charter Communications/Spectrum also provides telephone and internet services in the public utilities RSA in San Benito County (Charter Spectrum 2017).

Merced County

AT&T and Verizon are the primary telecommunications service providers in the public utilities RSA in Merced County. Comcast and CenturyLink also provide communications services in the RSA in Merced County.

Water Supply Infrastructure

This section summarizes water suppliers and infrastructure by community from north to south, west to east along the project alternatives. The discussion is organized by type of water supplies, focusing on potable water, recycled water, and nonpotable agricultural water. This section also summarizes water demand within the public utilities RSA. For additional discussion of groundwater, including a map of groundwater basins and information about applicable basin plans, refer to Section 3.8, Hydrology and Water Resources. Appendix 3.6-A in Volume 2 includes detailed information on major utilities, including water conveyance infrastructure, that cross or run parallel to the project alternatives.

Types of Water Supplies:

- Potable Water—Water that is safe to drink or for use in food preparation.
- Recycled Water—Treated wastewater that can be used for landscape irrigation, industrial uses, etc.
- Nonpotable Agricultural Water—Untreated water that is not of drinking water quality but is typically used for agricultural irrigation

Potable Water Suppliers

Municipalities and counties provide most of the potable water within the public utilities RSA. Potable water suppliers within the public utilities RSA are listed in Table 3.6-2 and their service area boundaries are illustrated on Figure 3.6-4 for Santa Clara and San Benito Counties and on Figure 3.6-5 for Merced County.

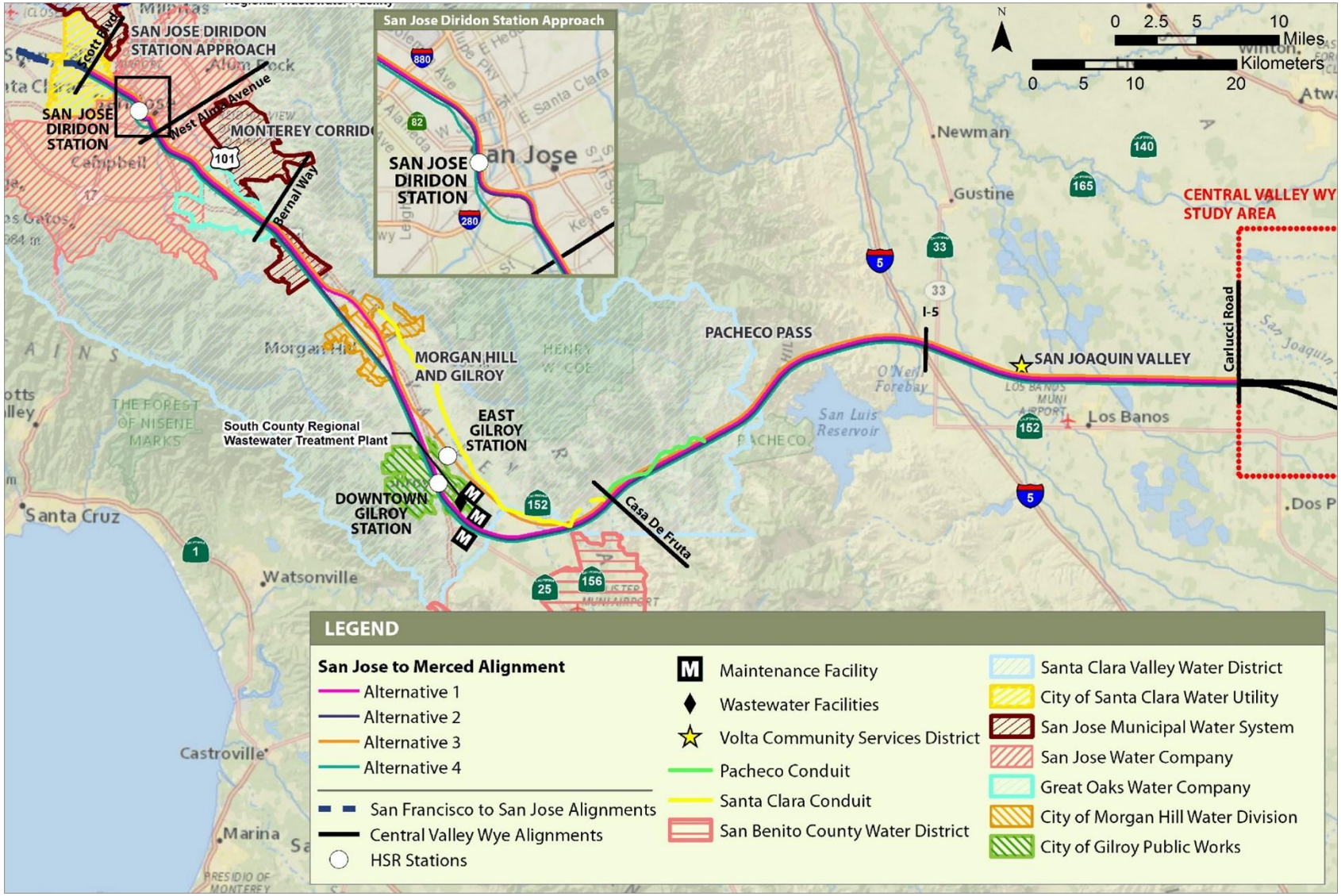
Santa Clara Valley Water District

The SCVWD supplies water to approximately 1.9 million people in Santa Clara County, primarily for residential use. The SCVWD water resource planning includes the *Santa Clara Valley Water District 2015 Urban Water Management Plan*. The plan provides demand and supply projections and current and projected sources of water for the SCVWD. The plan forms the basis of the SCVWD Water Supply and Infrastructure Master Plan (SCVWD 2016). In 2015, the SCVWD obtained about half of their water supply from local sources and half from imported water sources. The SCVWD imported water from outside the public utilities RSA from sources including the California Department of Water Resources (DWR) State Water Project (SWP), the Reclamation CVP, and San Francisco Public Utilities Commission (SFPUC). Local potable water sources include natural groundwater recharge and surface water supplies, including surface water rights held by SCVWD and the San Jose Water Company (SJWC) (SCVWD 2016a). In addition to natural drainage features, the SCVWD's water supply infrastructure is comprised of storage, conveyance facilities, recharge facilities, diversion facilities, dams and reservoirs, groundwater subbasins, groundwater recharge systems, water treatment plants, treatment and distribution facilities, pump

stations, and raw water conveyance systems (SCVWD 2016a). Many residents in rural and unincorporated areas of Santa Clara County rely on private groundwater wells for potable water. The SGMA requires designation of a Groundwater Sustainability Agency. The SCVWD is the Groundwater Sustainability Agency for the Santa Clara subbasin, the Llagas subbasin, and portions of the Hollister subbasin and the San Juan Bautista subbasin that are within Santa Clara County. The SGMA requires preparation of a Groundwater Sustainability Plan for all medium- and high-priority groundwater basins. The SCVWD Groundwater Management Plan (SCVWD 2016b) was submitted to the California DWR as an alternative to a Groundwater Sustainability Plan in December 2016 (SCVWD 2018).

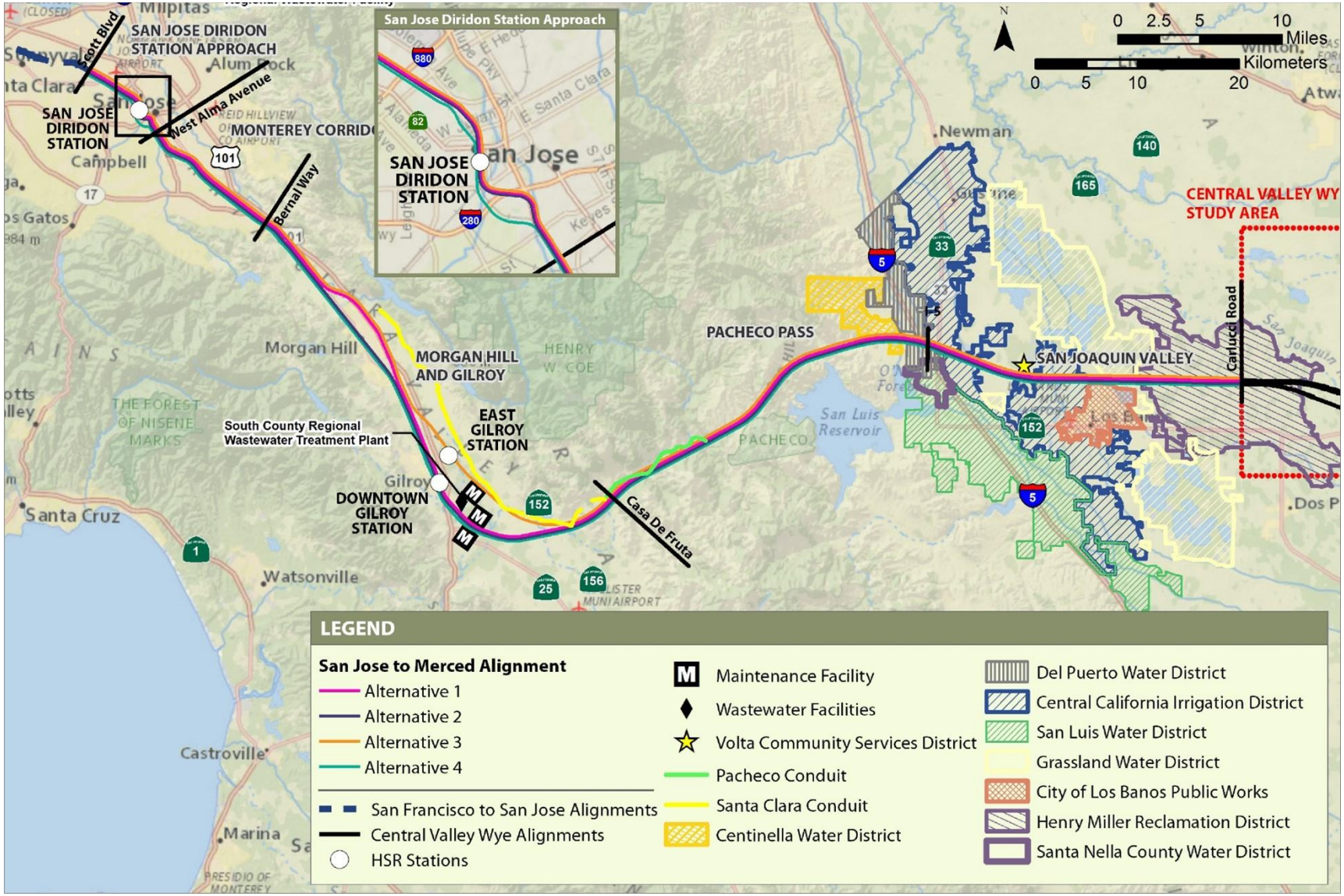
U.S. Department of the Interior, Bureau of Reclamation

Reclamation operates the San Felipe Division of the CVP in Santa Clara County and San Benito County (Reclamation 2020). Water from the San Luis Reservoir in Santa Clara County is transported to the Santa Clara–San Benito Reclamation service area through Pacheco Tunnel and CVP infrastructure, including 48.5 miles of closed conduits in Santa Clara County and San Benito County and two pumping plants (Reclamation 2020). Water is conveyed from the Delta of the San Joaquin and Sacramento Rivers through the Delta-Mendota Canal to O'Neill Forebay. Water is then pumped from O'Neill Forebay into San Luis Reservoir and diverted through the 1.8 miles of Pacheco Tunnel Reach 1 to the Pacheco Pumping Plant. Water is lifted at the Pacheco Pumping Plant to the 5.3-mile high-level section of Pacheco Tunnel Reach 2. The water flows through the tunnel and through the Pacheco Conduit to the bifurcation of the Santa Clara and Hollister Conduits near the border of Santa Clara and San Benito Counties. Water is conveyed from the conduits throughout the service areas in Santa Clara County and San Benito County for irrigation and municipal uses. The Santa Clara Conduit crosses the northern edge of San Benito County and reenters Santa Clara County (SCVWD 2020). The locations of the San Felipe Division infrastructure are illustrated on Figure 3.6-4 and Figure 3.6-5. This infrastructure is operated and maintained by SCVWD pursuant to an operations and maintenance agreement. SCVWD, a water distributor in Santa Clara County, is supplied through the Santa Clara Conduit.



NOVEMBER 2020

Figure 3.6-4 Potable Water Distribution System Boundaries



NOVEMBER 2020

Figure 3.6-5 Agricultural Irrigation District Water System Boundaries

San Jose Municipal Water System

The San Jose Municipal Water System (SJMWS) provides potable water to approximately 113,650 residents in the San Jose neighborhoods of North San Jose/Alviso, Evergreen, Edenvale, and Coyote Valley. The SJMWS relies on four water sources: surface water from SFPUC, local and imported surface water from SCVWD, groundwater from the Santa Clara Subbasin, and recycled water from the South Bay Water Recycling (SBWR) system. The North San Jose/Alviso neighborhood's potable water supply is primarily surface water from SFPUC, most of which originates from the Hetch Hetchy Reservoir in the Sierra Nevada, and is supplemented by groundwater wells owned and operated by SJMWS (SFPUC 2016). In the neighborhoods of Edenvale and Coyote Valley, groundwater from the Santa Clara Subbasin provides for most of the potable water use. The Evergreen service area receives both treated surface water and groundwater supply from SCVWD. The SJMWS also purchases treated surface water from SCVWD under a treated water contract.

City of Santa Clara Water Utility

The City of Santa Clara Water Utility supplies potable water to approximately 26,000 residents in Santa Clara. Water sources available to the City of Santa Clara Water Utility include a local underground aquifer, which provides about 62 percent of the City's potable water through 26 wells, and imported water supplies delivered by the SCVWD and the SFPUC (City of Santa Clara 2018).

San Jose Water Company

The SJWC is the primary source of potable water for the metropolitan area of San Jose. The SJWC sources potable water supplies from groundwater, local surface water, and imported treated surface water (SJWC 2016). Typically, groundwater comprises approximately one-third of SJWC's potable water supply, surface water from the local watersheds of the Santa Cruz Mountains comprises about 7 percent, and imported treated surface water originating from local reservoirs, the SWP, and the CVP comprise more than 50 percent of its potable water (SJWC 2016). SJWC's distribution system has interties with City of Santa Clara, City of San Jose Municipal Water, City of Milpitas, and Great Oaks Water Company.

Great Oaks Water Company

The Great Oaks Water Company provides potable water to approximately 20,000 residents in the San Jose neighborhoods of Blossom Valley, Santa Teresa, Edenvale, Coyote Valley-Almaden Valley. The Great Oaks Water Company sources their potable water from underground water supplies in the Santa Clara Valley Groundwater Basin (Great Oaks Water Company 2015, 2018).

City of Morgan Hill Water Division

The City of Morgan Hill Water Division provides potable water services in Morgan Hill through the use of 17 municipal groundwater wells that tap into the Llagas Subbasin of the Gilroy-Hollister Groundwater Basin and the Santa Clara Subbasin of the Santa Clara Valley Groundwater Basin (City of Morgan Hill 2015a, 2015b, 2016b, 2017b). Residential and commercial water users in the Morgan Hill area also rely on groundwater withdrawn from the Llagas Subbasin and the Coyote Valley subarea of the Santa Clara Subbasin. The SCVWD monitors these subbasins and provides transfers of surface water and raw water for the purposes of recharge of the Llagas Subbasin and the Coyote Valley subarea of the Santa Clara Subbasin. The SCVWD noted in the January 2016 Groundwater Condition Report that groundwater levels were below the 5-year average for both subbasins. Based on demand projections presented in the South County Water Supply Planning Project dated July 2010, the Llagas Subbasin is expected to experience a water supply shortfall in 2030. As the city continues to grow, planning efforts have recommended increasing groundwater recharge and use of recycled water to meet additional water needs, and if necessary, treatment and use of local surface waters (SCVWD 2010b).

City of Gilroy Public Works Department

The City of Gilroy's Public Works Department provides potable water services to approximately 56,000 residents in Gilroy through nine groundwater wells that connect to the Llagas Subbasin of the Gilroy-Hollister Groundwater Basin (City of Gilroy 2016b). As described for the City of Morgan Hill, the Llagas Subbasin is expected to experience a water supply shortfall in the future, which

could be offset by increasing groundwater recharge, use of recycled water, or treatment of local surface waters (SCVWD 2010b).

San Benito County Water District

The San Benito County Water District (SBCWD) provides water to municipal and rural land uses in San Benito County through four major sources of water supplies: local groundwater, imported water, recycled water, and local surface water. The SBCWD, Sunnyslope County Water District, and the City of Hollister jointly prepared the 2015 Hollister Urban Area (HUA) Urban Water Management Plan. The plan describes the current and projected water demand for the HUA and identifies sources of water supply and plans for future water supply facilities (County of San Benito 2016b). Local groundwater, which provides approximately 83 percent of the total supply, is withdrawn from the basin by private irrigation, domestic wells, and public water supply retailers. Imported water, from Reclamation's CVP, is approximately 16 percent of the total supply. The SBCWD has a 40-year contract (extending to 2027) to purchase CVP water from Reclamation for a maximum of 8,250 acre-feet per year of municipal and industrial water. Local surface water is not used directly for potable use in the basin, but creek percolation is a significant source of groundwater recharge (SBCWD 2015). Reclamation assets that the SBCWD shares with the SCVWD are the Pacheco Tunnel, Pacheco Pumping Plant, and Pacheco Conduit (SBCWD 2018).

Merced County Reclamation Districts

Reclamation's CVP and the DWR's SWP provide potable water to municipal and special water districts in Merced County through the Delta-Mendota Canal and the California Aqueduct. The Delta-Mendota Canal, jointly operated by Reclamation and the SLDMWA, delivers water to the San Luis Reservoir; this water is then pumped to a facility in the Pacheco Pass near Casa de Fruta, where the water is diverted to the SCVWD and SBCWD (SBCWD 2018).

Special water districts generally provide potable water to unincorporated areas of Merced County. Special water districts within the public utilities RSA include the SLDMWA, the Henry Miller Reclamation District (HMRD)/San Luis Canal Company (SLCC), the San Luis Water District (SLWD), and the Central California Irrigation District (CCID). Municipal areas including Santa Nella, Volta, and Los Banos operate municipal water systems for residents that are typically supplied by groundwater wells.

Santa Nella County Water District

The Santa Nella County Water District provides potable water to approximately 500 customers in the unincorporated community of Santa Nella. The Santa Nella water system is supplied from groundwater wells; Santa Nella is also supplied with treated surface water from the San Luis Canal (Nolte 2009; Santa Nella County Water District 2017a).

Volta Community Services District

The Volta Community Services District provides potable water to approximately 30 customers in the unincorporated community of Volta. The Volta water system is supplied from groundwater wells (Nolte 2009; Santa Nella County Water District 2017a).

City of Los Banos Public Works Department

The City of Los Banos obtains its water supply from the Delta-Mendota Subbasin groundwater aquifer via a series of wells. The City's water system includes 13 active wells, a distribution system with line sizes ranging from 4 to 30 inches in diameter, an elevated storage tank, and a surface-mounted storage tank with pumps. The City of Los Banos does not currently use surface water, but may use treated surface water purchased through the SWP in the future (City of Los Banos 2010).

City of Merced Public Works Department

The City of Merced Public Works Department is the only municipal water purveyor in the City of Merced and provides service to approximately 83,962 residents (as of 2015) with the city limits and in areas adjacent to the City including University of California-Merced, comprising a total of 44.7 square miles of service area. The City of Merced obtains water from the Merced Subbasin of the San Joaquin Valley Groundwater Basin and operates 20 active and standby groundwater wells. The City of Merced does not receive and does not anticipate receiving wholesale water (City of Merced 2017).

Recycled Water Suppliers

Cities of Santa Clara and San Jose

SBWR is a recycled water wholesaler to water retailers including the City of Santa Clara and two San Jose water suppliers (SJWC and SJMWS). The SBWR delivers approximately 6 billion gallons per year (approximately 11 million gallons per day [mgd]) of recycled water to more than 850 commercial customers (City of San Jose 2018b). Recycled water from the SBWR makes up about 16 percent of the water sales of the City of Santa Clara Water Utility (City of Santa Clara 2018). The SBWR obtains recycled water from the San Jose-Santa Clara Regional Wastewater Facility (jointly owned by the Cities of Santa Clara and San Jose and operated by the City of San Jose's Environmental Services Department). This wastewater treatment facility treats and distributes water to customers in San Jose, Santa Clara, and other jurisdictions in northern Santa Clara County for nonpotable agricultural and industrial uses (City of San Jose 2018b). The Silicon Valley Advanced Water Purification Center (SVAWPC) adjacent to the regional wastewater facility further purifies the recycled water and blends it with tertiary treated water to produce high-quality recycled water. The SVAWPC is conducting a project to demonstrate the effectiveness of advanced treatment technologies to produce potable water for a potable water reuse program (SCVWD 2016a).

City of Gilroy

The SCRWA WWTP in Gilroy produces recycled water for nonpotable uses such as irrigation, agriculture, and industrial uses. The SCVWD partners with SCRWA, City of Gilroy, and City of Morgan Hill to operate the recycled water program—the SCRWA is the recycled water producer, the SCVWD is the wholesaler, and Gilroy and Morgan Hill are the retailers (SCRWA 2017). In 2014–2015, 1,995 acre-feet per year of recycled water was used by 11 customers in Gilroy. As of May 2016, recycled water was not yet being delivered to customers in Morgan Hill; however, the SCRWA Recycled Water Management Plan identifies an additional 80 potential customers in Gilroy and 79 potential customers in Morgan Hill (SCVWD 2016a).

City of Merced

The City of Merced Public Works Department supplies recycled water for agricultural use on City-owned land, storm drain flushing, and for wetlands and wildlife habitat. The City of Merced used 4,886 acre-feet of recycled water for these purposes in 2015, approximately 45 percent for wetlands and habitat and approximately 55 percent for municipal and agricultural uses (City of Merced 2017).

Nonpotable Agricultural Water Suppliers

Santa Clara County

The SCVWD provides water to agricultural users in Santa Clara County and actively manages aquifers that are used to supply water to agricultural users. Agricultural users in the southern part of Santa Clara County rely primarily on groundwater withdrawn from groundwater wells in the Coyote and Llagas Subbasins for their water supply. The SCVWD actively manages these subbasins through groundwater recharge to augment the water supply. Sources of water for recharge include water captured and stored in local reservoirs and water imported from the SWP and the CVP through SLDMWA (SCVWD 2010a, 2016). Current (2015) and projected (2040) agricultural water consumption in Santa Clara County is 27,700 acre-feet per year including 26,000 acre-feet per year of agricultural groundwater consumption and 1,700 acre-feet per year of independent groundwater consumption used for irrigation or landscaping (SCVWD 2016b).

San Benito County

The SBCWD has four major sources of water supply for agricultural uses: local groundwater, imported water, recycled water, and local surface water. The SBCWD has a 40-year contract to purchase CVP water from Reclamation for a maximum 35,550 acre-feet per year of agricultural water (SBCWD 2016, 2017).

Merced County

The public utilities RSA extends through unincorporated Merced County in an area that is primarily agricultural and open space; water is typically supplied by individual groundwater wells or federal and state water projects (County of Merced 2012). The primary water infrastructure

within the public utilities RSA are irrigation canals owned or regulated by the following agencies and departments (illustrated on Figure 3.6-5):

- **Reclamation**—Reclamation operates the CVP including the Delta-Mendota Canal and San Luis dam and reservoir in Merced County (Reclamation 2018). The CVP provides agricultural and municipal water to numerous water districts in Merced County (SLWD 2012).
- **SLDMWA**—The SLDMWA consists of water agencies representing approximately 2,100,000 acres within the western San Joaquin Valley including portions of Santa Clara, San Benito, and Merced Counties. The SLDMWA operates the Delta-Mendota Canal jointly with Reclamation, a canal which delivers approximately 3,000,000 acre-feet per year of water within the SLDMWA service area. Approximately 83 percent of this water supply is used for agriculture, 7 percent for municipal and industrial uses, and 9 percent for habitat enhancement and restoration at wildlife refuges. The SLDMWA also operates the O'Neill Pumping/Generating Plant at San Luis/O'Neill Forebay Reservoir, the San Luis Drain and other water infrastructure facilities under a cooperative agreement with Reclamation (SLDMWA 2018, 2019).

  The Westside-San Joaquin Region of the SLDMWA includes water agencies in western Merced County. Water supplies within the Westside-San Joaquin Region of the SLDMWA include CVP water, groundwater, local surface water including recycled water, and water transferred from outside the Westside-San Joaquin Region (SLDMWA 2019). Municipal water suppliers in this region, including the City of Los Banos, have prepared UWMPs, and 11 agricultural water suppliers within the region have prepared agricultural water management plans. The region primarily overlies the southern portion of the Tracy Groundwater Subbasin, the Delta-Mendota Groundwater Subbasin, and the Westside Groundwater Subbasin of the San Joaquin Valley Groundwater Basin.
- **California DWR**—The California DWR operates and maintains the San Luis Joint-Use Complex, which includes O'Neill Dam and Forebay, Sisk Dam, San Luis Reservoir, Gianelli Pumping-Generating Plant, Dos Amigos Pumping Plant, and a 103-mile portion of the California Aqueduct in Merced County. This complex serves the SWP and the CVP (DWR 2018).
- **HMRD/SLCC**—The HMRD operates and maintains canals and drains for the SLCC within Merced County, including areas east of Los Banos. The HMRD in conjunction with the SLCC deliver irrigation water and provide drainage services to SLCC customers. The SLCC services an area of approximately 47,285 acres in Merced and Fresno Counties. The SLCC has an annual contractual entitlement of 163,000 acre-feet provided by the CVP (SLCC 2014; Reclamation 2014).
- **Grassland Water District**—The Grasslands Water District (GWD) is approximately 51,540 acres in size with most of the land within the district being wetland habitat to the northwest and southeast of Los Banos. The GWD's primary operation is the delivery of water to landowners within its boundaries using a 110-mile canal system. The GWD receives an annual allotment of water for distribution from the CVP (GWD 2017).
- **CCID**—The CCID provides water to approximately 1,600 farms in the vicinity of Gustine, Santa Nella, Los Banos, and other areas in Merced County. The CCID also provides municipal and industrial water to customers in their service area. The CCID obtains water from Reclamation. The CCID services approximately 142,000 acres of irrigated agricultural land and approximately 5,000 metered water connections east of I-5 and west of the San Joaquin River. In 2011, the CCID received 510,000 acre-feet of water from Reclamation and also obtained 45,300 acre-feet of drainage water (CCID 2014b, 2017).
- **SLWD**—SLWD is on the western side of the San Joaquin Valley near Santa Nella and Los Banos and extends from Merced County into Fresno County. The SLWD covers 64,500 acres and includes 30,954 irrigated acres and approximately 700 metered water connections. The SLWD does not operate groundwater wells and receives all of its water from the Reclamation Delta-Mendota Canal and has an allocation of 125,080 acre-feet. (SLWD 2012, 2016).

- **Del Puerto Water District**—The Del Puerto Water District runs parallel to the Delta-Mendota Canal in Merced County northwest of Santa Nella and extends 50 miles into Stanislaus County. The Del Puerto Water District's service area encompasses 45,000 acres of farmland along the Delta-Mendota Canal, and receives water from the CVP (Nolte 2009; Del Puerto Water District 2011).
- **Centinella Water District**—The Centinella Water District comprises 840 irrigable acres. In 2004, the Centinella Water District sold its contract with Reclamation, and the Centinella Water District currently has no allocation of water for distribution. The land in the District is designated as habitat for mitigation purposes. The Centinella Water District Manager has begun exploring the steps required to dissolve the District (LAFCO 2017).

Potable Water Demand

Acre-foot of water

An acre-foot of water is the volume equal to a sheet of water 1 acre in area and 1 foot in depth.

The demand for potable water in urban areas of the public utilities RSA was approximately 165,724 acre-feet per year in 2015, with the highest demand in San Jose (139,907 acre-feet per year). The SCVWD supplies wholesale potable water to municipal water service providers in Santa Clara County including the Cities of Santa Clara, San Jose, Morgan Hill, and Gilroy. In Merced County, the City of Los Banos, Santa Nella, and Volta operate municipal water supply systems in the RSA. Water demand for the Cities of Santa Clara, San Jose, Morgan Hill, and Gilroy in Santa Clara County and the City of Los Banos, Santa Nella, and Volta in Merced County is projected to increase by approximately 70 percent to 280,490 acre-feet per year by 2040. Table 3.6-4 shows potable water supplies for urban areas of the RSA.

Table 3.6-4 Existing and Projected Urban Potable Water Demand in the Resource Study Area

Water Utility/Water District	Demand (acre-feet/year)[1]	
	Current (2015)	Future Projected (2040)
City of Santa Clara Water Utility (City of Santa Clara)	17,620	27,040
San Jose Water Company (City of San Jose)	106,580	161,070
San Jose Municipal Water System (City of San Jose)	15,710	35,200
Great Oaks Water Company (City of San Jose)	2,760	4,070
City of Morgan Hill Water Division[2]	5,380	10,970
City of Gilroy Public Works[3]	8,140	17,870
Santa Nella County Water District[4]	2,500	4,750
Volta Community Services District[4]	375	710
City of Los Banos Public Works	6,660	18,820

Sources: SCVWD 2016a; City of Santa Clara 2016; SJWC 2016; San Jose Municipal Water System 2016; City of Morgan Hill 2016a; City of Gilroy 2016b; City of Los Banos 2016; Nolte 2009.

[1] 1 acre-foot of water is equivalent to 325,851 gallons.

[2] Includes water consumption for landscaping use; does not include estimated demand associated with other water users in the Morgan Hill area that rely on groundwater withdrawals from the Llagas Subbasin and Coyote Valley subarea of the Santa Clara Subbasin.

[3] Includes recycled water consumption.

[4] 2015 values for Santa Nella and Volta, are estimated based on Nolte 2009.

Water Supply

Santa Clara Valley Water District

Sources of water supply for the SCVWD include natural groundwater recharge, local surface water, imported surface water from the SWP and CVP, recycled water, and transfers. The SFPUC delivers water to retailers in northern Santa Clara County, and the SJWC has local surface water rights (SCVWD 2016a). The SCVWD 2015 Urban Water Management Plan includes projections of average annual water supply to 2040 and includes water supply reliability analysis for water supplies in single and multiple dry years (SCVWD 2016a).

The SCVWD countywide water supply in 2015 was 260,000 acre-feet. The SCVWD projected water supply is 438,100 acre-feet in 2025 and 441,900 acre-feet in 2040. Water supplies are anticipated to increase from 2015 levels with the completion and implementation of future water supply projects including dam improvements, potable water reuse and recycled water programs, and water pipeline construction and restoration (SCVWD 2016a).

The SCVWD projected countywide water demand in 2025 is 391,400 acre-feet; the projected 2025 water supply exceeds the projected 2025 water demand by 36,800 acre-feet. The SCVWD projected water demand in 2040 is 435,100 acre-feet; the projected 2040 water supply exceeds the projected 2040 water demand by 6,800 acre-feet. Projected demand and projected supply are anticipated to be equal for normal dry years, including access to reserves, except for 2040, for which reserves are projected to be insufficient, resulting in a projected shortfall of 25,800 acre-feet for 2040. Shortfalls are predicted for multiple dry years from 2020 to 2040; the SCVWD has updated its Master Water Plan (2017) and is conducting interagency planning to identify and develop additional water supplies to account for multiple dry years (SCVWD 2016a).

San Benito County Water District

The SBCWD receives water from the CVP under a 40-year contract (extending to 2027) for a maximum of 8,250 acre-feet per year for municipal and industrial water and 35,550 acre-feet per year of water for agricultural use. The SBCWD manages the San Justo Reservoir to store imported CVP water, with a planned reserve of 3,000 acre-feet. Groundwater wells in the HUA operated by water retailers also provide water to Hollister and Sunnyslope; the City of Hollister and the Sunnyslope County Water District are municipal water purveyors. The HUA water supply increased from 2015 levels with completion of the Hollister-West Hills Treatment Plant in 2017. The West Hills plant provides additional treatment capacity for CVP water; the treated water is blended with groundwater for distribution to customers (Hollister Free Lance 2017).

The HUA water demand in 2015 was 4,880 acre-feet. The projected demand in 2020 is 6,936 acre-feet and the projected demand in 2025 is 7,740 acre-feet. The projected normal year water supply in both 2020 and 2025 is 11,539 acre-feet including 7,245 acre-feet of purchased or imported water, 3,999 acre-feet of groundwater, and 116 acre-feet of recycled water. The difference between projected supply and demand in 2020 is 4,603 acre-feet and in 2025 is 3,799 acre-feet. Supply and demand are anticipated to be equal in dry and multiple dry years after application of water conservation measures (SBCWD 2016).

City of Merced Public Works Department

Sources of water supply to the City of Merced include groundwater and recycled water. The projected water supply in 2025 is 33,287 acre-feet including 5,821 acre-feet of recycled water, and the projected water supply in 2035 is 37,829 acre-feet including 5,869 acre-feet of recycled water. Water demand in 2025 and water demand in 2035 are projected to be equal to projected water supply; water conservation measures are anticipated to reduce water demand in dry and multiple dry years to equal the available supply and groundwater pumping will compensate for reduced surface water allocations (City of Merced 2017).

Agricultural Water Demand

Santa Clara County

Agricultural water use for irrigation in Santa Clara County was 37,500 acre-feet per year in 2010. Most of this agricultural water use was from groundwater (91.6 percent or 34,350 acre-feet per

year), while the remaining was from surface waters (8.4 percent or 3,150 acre-feet per year) (USGS 2017).

San Benito County

Agricultural water use for irrigation in San Benito County was more than twice that of Santa Clara County in 2010, at 80,900 acre-feet per year. Of this agricultural water use, 72 percent or 58,250 acre-feet per year was from groundwater sources, and 28 percent or 22,650 acre-feet per year was from surface water (USGS 2017).

Merced County

Agricultural water use for irrigation in Merced County was 1.54 million acre-feet per year in 2010. Unlike Santa Clara and San Benito Counties, most of this agricultural water use for irrigation was from surface water (71 percent or 1.1 million acre-feet per year), and the remaining from groundwater (29 percent or 0.4 million acre-feet per year) (USGS 2017).

Wastewater Collection and Treatment

Wastewater collection and treatment services are provided by municipal and county agencies within the public utilities RSA. On-site sewage systems (e.g., septic tanks) are generally used in rural and low-density areas of the RSA, including some unincorporated areas of Santa Clara, San Benito, and Merced Counties. More densely populated and urban areas of the RSA are serviced by wastewater treatment systems operated by municipal agencies. Table 3.6-5 summarizes local wastewater system locations and operating and design capacities for urban areas of Santa Clara County and Merced County.

Table 3.6-5 Wastewater Treatment Plant Capacity within the Resource Study Area

Location	Wastewater Treatment Plant	Operator	Address	Design Capacity (mgd)	Average Dry Weather Flow (mgd)
City of San Jose[1]	San Jose-Santa Clara Regional Wastewater Facility	City of San Jose Environmental Services Department	700 Los Esteros Road, San Jose	167	105
City of Gilroy[2]	SCRWA Wastewater Treatment Plant	South County Regional Wastewater Authority	1500 Southside Drive, Gilroy	8.5	6.0
City of Los Banos	Los Banos Wastewater Treatment Plant	City of Los Banos Public Works	17963 W Henry Miller Road, Los Banos	6.1[3]	3.4[3]
Santa Nella	Santa Nella Wastewater Treatment Plant	Santa Nella County Water District	12931 S. Highway 33, Santa Nella	0.4	0.3

Source: City of San Jose 2018c; SCRWA 2016; SCVWD 2014, 2017; City of Los Banos 2010; EPS 2007.
[1] The City of Santa Clara and the City of San Jose are jointly served by a single wastewater treatment plant operated by the City of San Jose.
[2] Morgan Hill and Gilroy are served by and jointly operate a single wastewater treatment plant operated by the SCRWA.
[3] Additional 49,500 gallons per day is expected to be needed by 2020.
mgd = million gallons per day
SCRWA = South County Regional Wastewater Authority

Santa Clara County

Residents and businesses in urban areas of Santa Clara County receive sewage collection and wastewater treatment services from municipal sewer systems or special sanitary districts. Residents and businesses in unincorporated areas of Santa Clara County generally rely on septic systems or on-site wastewater treatment systems for management of wastewater (County of Santa Clara 1994, 2016). The Santa Clara County Consumer Protection Division oversees on-

site wastewater treatment systems through the County On-Site Wastewater Treatment System Ordinance (County of Santa Clara 2013).

City of Santa Clara

The City of Santa Clara Sewer Utility provides sewer services to residents and businesses in the city. Sanitary sewer flows are collected and transported through more than 270 miles of sewer main by way of six pumping stations to the San Jose-Santa Clara Regional Wastewater Facility (City of Santa Clara 2018). This facility, jointly owned by the Cities of Santa Clara and San Jose and operated by the City of San Jose's Environmental Services Department, provides primary, secondary, and tertiary wastewater treatment to remove solids, pollutants, and harmful bacteria (City of Santa Clara 2018). This wastewater facility can process up to 167 mgd of untreated wastewater and discharges most of the treated wastewater through Coyote Creek into South San Francisco Bay (City of San Jose 2018b). About 20 percent of the treatment facility discharge is recycled for use in agriculture/landscape irrigation, industrial processes, building cooling, and toilets and urinals.

City of San Jose

The City of San Jose Environmental Services Department collects wastewater from residents and businesses throughout the city (City of San Jose 2014). The sewer system consists of approximately 2,294 miles of wastewater collection system pipeline that ranges from 6 to 90 inches in diameter, and approximately 45,000 manholes and 17 sewage lift stations that convey to the San Jose-Santa Clara Regional Wastewater Facility by major interceptor pipelines in the northern part of San Jose. In addition to the City's collection system, wastewater is conveyed to the plant from several sewage collection systems operated by and serving Santa Clara and Milpitas, County Sanitation District 2-3, West Valley Sanitation District, Cupertino Sanitary District, and Burbank Sanitary District. Sewage generated within SJWC and SJMWS service areas is conveyed through the City of San Jose and West Valley Sanitation District collection systems and treated at the San Jose-Santa Clara Regional Wastewater Facility.

City of Morgan Hill

The City of Morgan Hill's Department of Public Works operates a wastewater collection system that collects wastewater within the City's service area and transports it to the SCRWA WWTP in Gilroy for processing (City of Morgan Hill 2002a). The Morgan Hill sewer system consists of approximately 135 miles of sewers with diameters up to 30 inches, 15 sewage lift stations, associated force mains, an interceptor and trunk sewers (generally 12 inches in diameter and larger) that convey wastewater through an outfall that continues south of the city to the WWTP in Gilroy, where it is treated and discharged.

The SCRWA owns and operates the WWTP under a Joint Powers Agreement with Morgan Hill and Gilroy (SCRWA 1992, 2017). The WWTP can process up to 8.5 mgd of untreated wastewater. A 3-million-gallon storage reservoir is located on-site at the WWTP to support the recycled water distribution system, described in more detail in the Recycled Water Suppliers section (SCRWA 2016). The WWTP discharges the remaining treated wastewater into percolation ponds. The ponds allow the water to soak into the soil and eventually add water to the underground aquifer. The ponds allow for settling out of solids and are further distributed through a pipe system (SCRWA 2017).

City of Gilroy

The City of Gilroy's Water Department operates a wastewater collection system that collects wastewater within the City's service area and transports it to the SCRWA WWTP in Gilroy (City of Gilroy 2004b). The Gilroy sewer system consists of approximately 110 miles of sewers with diameters up to 33 inches and trunk sewers (generally 10 inches in diameter and larger) that convey wastewater to the WWTP (SCRWA 2016).

San Benito County

The San Benito County Resource Management Agency is responsible for planning, operation, and maintenance of sewer collection systems within San Benito County (County of San Benito 2018). Most unincorporated areas of San Benito County lack public sewer infrastructure and are serviced by community septic systems or individual septic systems and leach field disposal.

Incorporated areas of San Benito County including Hollister and San Juan Bautista are serviced by municipal wastewater and sewer services. WWTPs in San Benito County are operated by four service providers: City of Hollister, City of San Juan Bautista, Sunnyslope Water District, and Tres Pinos Water and Sewer District. Four unincorporated communities in San Benito County are served by public wastewater systems operated by four Community Service Area service providers (County of San Benito 2010, 2015a).

Merced County

Sanitary sewer service is provided by special districts, including community service districts, water districts, and sanitary districts within some unincorporated communities in Merced County. Unincorporated communities that lack sanitary sewer infrastructure are serviced by septic systems (County of Merced 2013).

Santa Nella

The Santa Nella County Water District collects, treats, and disposes of wastewater within their service area. The water district owns, maintains, and operates all wastewater facilities within their service area, including the Water District's 0.4 mgd capacity WWTP adjacent to the San Luis Wasteway. Wastewater is treated in aerated ponds and then is discharged to land for disposal (Santa Nella County Water District 2017a; 2017b; County of Merced 2013).

Volta

Volta is not connected to a local sanitary sewer system. The community relies on individual or community septic systems for wastewater management (County of Merced 2016).

City of Los Banos

The City of Los Banos' Public Works Department collects, treats, and disposes of wastewater within their service area. The City owns, maintains, and operates all wastewater facilities within the sewer service area, which is approximately 4,580 acres (including developed and undeveloped land) or 7.2 square miles. Treatment of wastewater at the City of Los Banos WWTP is conducted in four treatment ponds and three storage ponds, totaling approximately 509 acres. Disposal of treated wastewater is accomplished by irrigation of pastureland, in addition to the percolation and evaporation of water that occurs in the ponds. The 14,380-acre (22.5-square-mile) Wastewater Management Master Plan study area extends beyond the city limits to include the boundaries of the CCID Main Canal and the GWD San Luis Canal. The Master Plan forecasts sewer improvements in this extended study area. The city maintains approximately 124 miles of sewer mains and trunk sewers, sanitary sewer lines 4–30 inches in diameter, and 13 lift stations. In addition to the collection system, the city also operates a WWTP northeast of the city. Los Banos is expanding the capacity of its existing WWTP to a capacity of 18.9 mgd. This capacity is projected to be adequate to serve General Plan buildout (City of Los Banos 2010, 2016).

Stormwater Management

Stormwater management is provided by municipalities in Santa Clara, San Benito, and Merced Counties in the developed urban areas and densely populated areas. In some of the less densely populated, rural, and unincorporated areas of the counties, roadside ditches, irrigation canals, and natural drainages convey stormwater runoff.

Santa Clara County

The Santa Clara County Clean Water Program oversees stormwater management through implementation of two regional NPDES municipal stormwater permits covering the northern section and southern section of Santa Clara County (County of Santa Clara 2018a). The San Francisco Bay RWQCB (Region 2) regulates waters discharging to San Francisco Bay from the northern section of the county and the Central Coastal Basin RWQCB (Region 3) regulates waters discharging to the Monterey Bay from the southern section of the county (County of Santa Clara 2018a; San Francisco RWQCB 2017; Central Coastal RWQCB 2019). Stormwater management systems in urban areas of Santa Clara County are operated and maintained by municipal public works departments. Stormwater management systems on public roads in unincorporated areas of Santa Clara County are maintained by the Santa Clara County Roads Administration. The County maintains 635 miles of rural and urban roadways in unincorporated areas, including 2,185 drain inlets (County of Santa Clara 2018b).

City of Santa Clara

The City of Santa Clara Public Works Department operates and maintains the storm sewer and stormwater management system in the City of Santa Clara (City of Santa Clara 2018). The stormwater management system includes 22 stormwater pump stations and an estimated 200 linear miles of pipe (8,452 links) and 8,452 nodes (including manholes, catch basins, pump stations, detention basins, and outfalls) (City of Santa Clara 2015).

City of San Jose

The City of San Jose's Department of Transportation operates and maintains the storm sewer system in San Jose. Construction of new portions of the storm drain system is the responsibility of the Department of Public Works. The City of San Jose's storm drainage system consists of more than 1,100 miles of storm drain lines, 35,500 catch basins and 31 stormwater pump stations (City of San Jose 2016).

City of Morgan Hill

The City of Morgan Hill Utilities Department operates its own storm drainage system within the city limits (City of Morgan Hill 2002b). The city's stormwater drainage system flows into existing channels and detention ponds owned and operated by the SCVWD. Morgan Hill's storm drainage system consists of a combination of curb and gutter facilities, curb inlets, underground pipelines, and bubblers draining to the nearest creek or to retention areas built to appear natural. The city is divided into several hydrologically distinct drainage areas, and each drainage area has a system of conveyance facilities, pumps, and detention basins to collect and dispose the runoff. The stormwater runoff from these areas is collected and ultimately discharged into creeks that flow through the city and are tributary to either Monterey Bay or San Francisco Bay. Each drainage area has a system of conveyance facilities, pumps, and basins to collect and dispose of the runoff.

City of Gilroy

The City of Gilroy Public Works Department owns, maintains, and operates its own storm drainage system within city limits, which flows into creeks and existing channels owned and operated by the SCVWD. The city's storm drainage system consists of a combination of curb and gutter facilities, curb inlets, and underground pipelines draining to the nearest creek or to constructed channel. The city is divided into several hydrologically distinct drainage areas. Each drainage area has a system of conveyance facilities to collect and dispose of runoff. The stormwater runoff from these areas is ultimately discharged into creeks that flow through the city and eventually reach Monterey Bay via the Pajaro River (City of Gilroy 2004a).

San Benito County

The San Benito County Resource Management Agency is responsible for planning, operation, and maintenance of stormwater collection systems within San Benito County (County of San Benito 2018). While most unincorporated areas of San Benito County are not served by stormwater drainage systems and instead rely either on individual stormwater drainage systems or small-scale stormwater drainage systems, five municipal service providers and several County Services Areas outside the public utilities RSA provide water and/or wastewater management services (County of San Benito 2015a). RWQCB Region 3 has jurisdiction over Santa Clara County (south of Morgan Hill) and northern San Benito County (San Francisco RWQCB 2017; Central Coast RWQCB 2019).

Merced County

The Merced County Department of Public Works is the lead agency for providing stormwater management infrastructure in unincorporated areas of Merced County. Developments in unincorporated areas are required to construct stormwater management systems, which Merced County then manages and operates. Drainage canals managed by irrigation districts in Merced County may be used to manage stormwater (County of Merced 2012). Unincorporated areas generally rely on surface drainage rather than underground stormwater management systems. RWQCB Region 5 has jurisdiction over Merced County (San Francisco RWQCB 2017; Central Valley RWQCB 2018).

Santa Nella

The Santa Nella County Water District operates and maintains stormwater management systems within Santa Nella. Stormwater runoff from Santa Nella is collected and drains into the San Luis Wasteway (Santa Nella County Water District 2017a).

Volta

Volta does not have roadside curbs and gutters or other engineered stormwater management systems (County of Merced 2016).

City of Los Banos

The City of Los Banos owns, maintains, and operates 21 stormwater pump stations, detention basins, and over 79 miles of storm drains 6 to 66 inches in diameter. It provides storm drainage services to its residential, commercial, institutional, and industrial customers within its service area. The existing storm drainage system collects and conveys surface water runoff throughout the city and discharges the runoff into canals operated and maintained by GWD or CCID. Storm retention basins capture most storm runoff, which is later discharged into water conveyance systems operated by the CCID or the GWD, although a few neighborhoods have direct discharge to canals. The CCID and GWD water conveyance systems follow historic drainage patterns in the region. The storm drainage system has neighborhood collection systems, detention basins, pump stations, and large-diameter storm drains. In addition, there are several major water features in the region. The major features include, but are not limited to Los Banos Creek, CCID Main Canal, GWD San Luis Canal, and GWD Santa Fe Canal (City of Los Banos 2010; EPS 2012).

Solid Waste Disposal

Solid Waste Disposal Facilities

The following sections discuss solid waste facilities that may serve the project. Table 3.6-6 summarizes landfill location, maximum permitted capacity, remaining capacity, and estimated closure date. There are three landfills in Santa Clara County, one landfill in San Benito County, and two landfills in Merced County that could provide solid waste disposal capacity for construction and operation of the project.

Santa Clara County

The three solid waste landfills within the public utilities RSA in Santa Clara County that could serve the project include the following:[3]

- **Kirby Canyon Recycling and Disposal Facility**—Waste Management of California, Inc. operates the Kirby Canyon Recycling and Disposal Facility. The facility is in southeastern San Jose and serves Santa Clara County and adjacent counties. As of July 2015, 45 percent of the permitted landfill capacity remained. The reported estimated closure date for this landfill is 2022; a permit extension to 2059 was proposed in October 2017 (CalRecycle 2019a, 2019g). Permitted waste types at this facility are Class III nonhazardous solid wastes, treated medical wastes and various alternative daily cover materials such as treated auto-shredder waste and petroleum hydrocarbon contaminated soils. The Kirby Canyon Recycling and Disposal Facility also accepts construction debris, nonfriable asbestos, contaminated soils, and industrial wastes and sludges with a solid content greater than 50 percent (Kirby Canyon Recycling and Disposal Facility 2002).

[3] The Zanker Road facility in the City of San Jose is a licensed recycling facility that is permitted to accept C&D debris wastes for recycling; the Zanker Road facility is not permitted as a solid waste disposal facility and does not have any solid waste disposal capacity (CalRecycle 2014a). The facility could be used for recycling of construction and demolition debris generated by project construction.

Table 3.6-6 Solid Waste Landfill Facility Permitted and Remaining Capacities

Landfill[1]	Landfill Permitted Daily Tonnage (tons per day)	Maximum Permitted Landfill Capacity (cubic yards)	Remaining Landfill Capacity (cubic yards)	Remaining Capacity as of Date	Estimated Permitted Closure Date
Santa Clara County					
Kirby Canyon Recycling and Disposal Facility	2,600	36,400,000	16,191,600	July 31, 2015	2022
Guadalupe Community Facility	1,300	28,600,000	11,055,000	January 01, 2011	2048
Newby Island Sanitary Landfill	4,000	57,500,000	21,200,000	October 31, 2014	2041
San Benito County					
John Smith Road Class III Landfill	1,000	9,354,000	4,625,800	November 30, 2012	2032
Merced County					
Billy Wright Landfill (Unit 01)	1,500	14,800,000	11,370,000	September 30, 2010	2054
Highway 59 Landfill [2]	1,500	30,012,000	28,025,000	September 01, 2005	2030
TOTAL	**11,900**	**176,666,000**	**92,467,400**	**N/A**	**N/A**

Source: CalRecycle 2019a, 2019b, 2019c, 2019d, 2019e, 2019f

[1] All landfills are permitted to accept construction and demolition wastes

[2] The Merced County Regional Waste Management Authority has proposed updating the 2030 closure date for the Highway 59 Landfill in the CalRecycle database to 2065 based on revised capacity calculations (Merced County Regional Waste Management Authority 2016).

- **Guadalupe Sanitary Landfill**—Guadalupe Rubbish Disposal Company, Inc. owns and operates Guadalupe Sanitary Landfill, which serves San Jose and southern Santa Clara County. According to CalRecycle data, this landfill was approximately 60 percent full as of January 2011; the landfill is projected to close in 2048 (CalRecycle 2019b). The permitted Class III landfill currently accepts yard waste and clean wood waste from residential self-haulers, gardeners and landscapers, governmental landscape maintenance and road crews, and franchised and nonfranchised municipal waste haulers. The facility also recycles wood waste that is transported to fuel markets and recycles C&D debris (e.g., soil, concrete, and asphalt), which is used on-site as construction material and daily landfill cover (County of Santa Clara 2014; Waste Management 2017a).
- **Newby Island Sanitary Landfill**—The International Disposal Corporation (also known as Republic Services) owns and operates Newby Island Sanitary Landfill, which serves all of Santa Clara County. It is in northern San Jose, just west of I-880. As of October 2014, the Newby Island Sanitary Landfill was approximately 65 percent full and it is projected to close in 2041 (CalRecycle 2019c). This landfill accepts C&D material, industrial and mixed municipal wastes, sludge (biosolids), tires, green materials, and contaminated soil, and recycles wood waste to fuel markets (County of Santa Clara 2014).

San Benito County

San Benito County owns and operates the John Smith Road Class III Landfill, which serves San Benito County. This is the only landfill in San Benito County and is in Hollister. As of November 2012, the John Smith Road Landfill was approximately 50 percent full; it is projected that the landfill will close in 2032 (CalRecycle 2019d). This landfill accepts agricultural, industrial, inert, and mixed municipal wastes. The landfill also accepts C&D and green materials, manure, tires, and wood waste (CalRecycle 2019d; John Smith Road Landfill 2017).

Merced County

The two landfills in Merced County that could provide solid waste disposal capacity for construction and operation of the project include the Billy Wright Landfill and the Highway 59 Landfill. A brief description of each follows:

- **Billy Wright Landfill**—Merced County and its incorporated cities jointly own and operate Billy Wright Landfill, which serves the western part of the county. As of September 2010, the Billy Wright Landfill was approximately 75 percent full, and the estimated landfill closure date is 2054. The Billy Wright Landfill accepts agricultural, C&D, and mixed municipal solid waste (CalRecycle 2019e).
- **Highway 59 Landfill**—Merced County and its incorporated cities jointly own and operate the Highway 59 Landfill approximately 1.5 miles north of the city of Merced. The Highway 59 Landfill accepts agricultural, C&D, and mixed municipal solid waste. The overall design capacity of the existing landfill is approximately 36,358,000 cubic yards, of which approximately 24,000,000 cubic yards was unused and available as of 2014 (CalRecycle 2019f). The estimated closure date of the landfill is 2030 according to the landfill's Solid Waste Facility Permit issued by CalRecycle, but the current estimated closure date is actually 2065 based on the corrected design capacity for the landfill; the Merced County Regional Waste Management Authority has proposed updating the closure date to 2065 by permit revision. A proposed landfill expansion project would extend the life of the landfill by approximately 15 years and design capacity by 6,857,000 cubic yards (Merced County Association of Governments 2016; Merced County Regional Waste Management Authority 2016).

Solid Waste Volumes

Table 3.6-7 summarizes waste disposal characteristics of communities in Santa Clara, San Benito, and Merced Counties. A total of approximately 1.1 million tons of solid waste was landfilled in Santa Clara, San Benito, and Merced Counties in 2015, with the largest amount (643,688 tons) from San Jose. Annual per capita disposal rates per resident range from 3.0 pounds per day (PPD) for unincorporated areas of Santa Clara County to 6.2 PPD for Morgan Hill (CalRecycle 2019h through 2019n). Annual per capita disposal rates per employee range from 9.1 PPD for San Jose to 19.2 PPD for San Benito County.

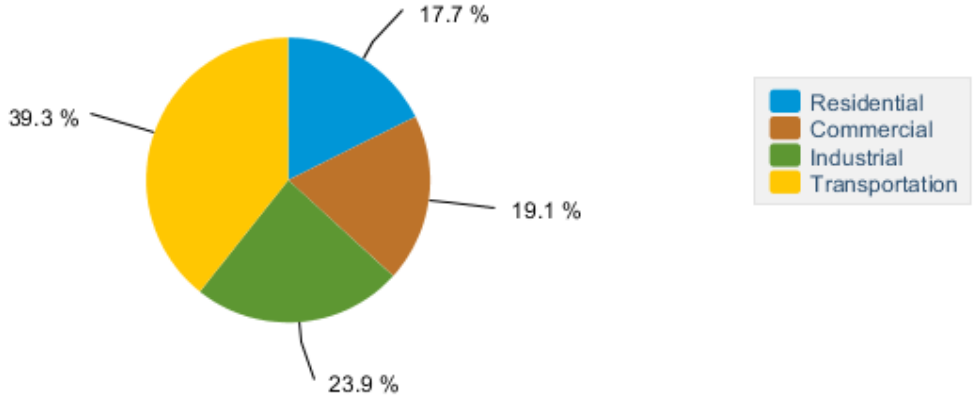
Table 3.6-7 Solid Waste Disposal Volumes and Diversion Summary

Jurisdiction	Amount of Solid Waste Landfilled in 2015 (tons)	Annual Per Capita Disposal Rate (PPD) Per Resident		Annual Per Capita Disposal Rate (PPD) Per Employee	
		Actual	Target	Actual	Target
Unincorporated Santa Clara County	48,390	3.0	4.0	9.9	13.1
City of Santa Clara	151,010	6.8	8.2	7.3	9.0
City of San Jose	643,775	3.5	5.2	9.1	14.5
City of Morgan Hill	47,440	6.2	6.1	17.1	16.3
City of Gilroy	48,324	5.0	6.2	14.8	16.1
San Benito County Integrated Waste Management Regional Authority[1]	72,450	6.8	5.1	24.6	18.3
Merced County Regional Waste Management Authority[2]	235,590	4.9	10.7	16.9	38.8
Total	**1,246,980**	**N/A**	**N/A**	**N/A**	**N/A**

Sources: CalRecycle 2019h, 2019i, 2019j, 2019k, 2019l, 2019m, 2019n,
[1] The San Benito County Integrated Waste Management Regional Agency includes management of waste from Hollister and San Juan Bautista and unincorporated communities in San Benito County; the Agency does not manage waste from other unincorporated areas of San Benito County.
[2] The Merced County Solid Waste Regional Authority includes management of waste from the cities of Merced, Livingston, Atwater Los Banos, Gustine, and Dos Palos. The Authority does not manage waste from unincorporated areas of Merced County.
N/A = not applicable
PPD = pounds per day

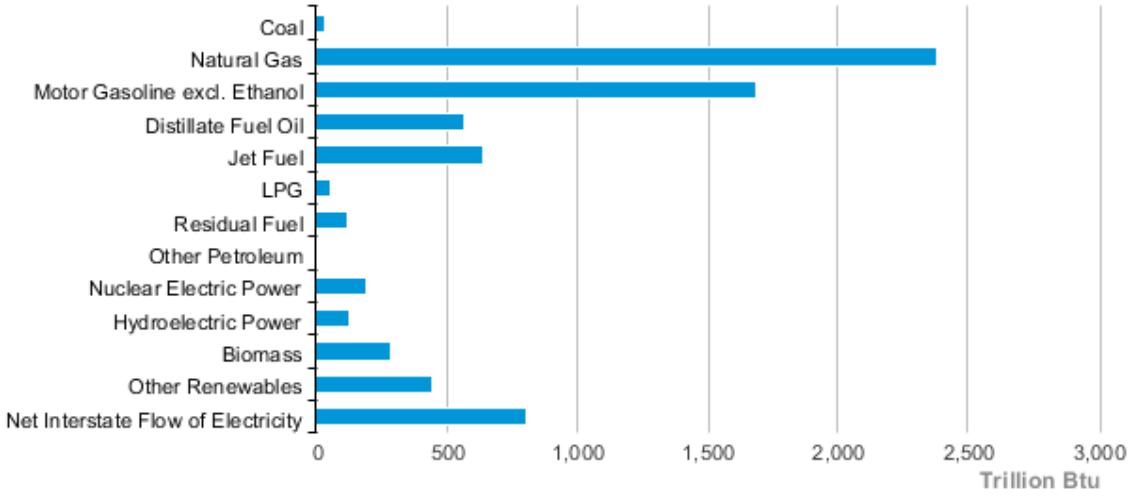
3.6.5.2 Energy

California's total energy consumption in 2015 was 7,322 trillion Btus. The transportation sector in 2015 accounted for 39.3 percent of California's energy use, the industrial sector 23.9 percent, the commercial sector 19.1 percent, and the residential sector 17.1 percent (EIA 2017b). Figure 3.6-6 illustrates California's energy consumption by sector in 2015, and Figure 3.6-7 illustrates the California energy consumption estimates by type in 2015.



Source: EIA 2017f

Figure 3.6-6 California Energy Consumption by Sector, 2015



Source: EIA 2017f

Figure 3.6-7 California Energy Consumption Estimates by Type, 2015

Petroleum products, including motor gasoline, distillate fuel oil, jet fuel, liquefied petroleum gas, residual fuel oil, and other petroleum, were the largest source of energy consumed in 2015 in California at 41.7 percent of the total in 2015, corresponding to 3,055 trillion Btus. The second largest source of energy consumed in California is natural gas, at 32.5 percent of the total in 2015, corresponding to 2,382 trillion Btus. Coal represented 0.4 percent of California's total energy consumption in 2015, corresponding to 21 trillion Btus (EIA 2017c). For energy consumption sources for the transportation sector in California in 2015, petroleum is by far the largest source at 97.4 percent, representing 2,974 trillion Btus (EIA 2017d). Ethanol is the second largest source of energy for transportation in California, at 4.1 percent, representing 124 trillion Btus, followed by natural gas (1.2 percent, representing 36 trillion Btus) and electricity (0.1 percent, representing 2.6 trillion Btus) (EIA 2017d, 2017e).

Electricity

Demand

There are two ways to measure electricity demand—consumption and peak demand. Electricity consumption is the total amount of electricity used over a period of time. According to the CEC, total statewide electricity consumption grew from 166,979 million kilowatt hours in 1980 to 283,000 million kilowatt hours in 2015 (CEC 2016a). Table 3.6-8 shows electricity consumption in Santa Clara, San Benito, and Merced Counties in 2015. Santa Clara County consumed the most electricity (83.5 percent of the region's 20,107 million kilowatt hours), followed by Merced County (14.5 percent), and San Benito County (2 percent).

Table 3.6-8 Electricity Consumption in Santa Clara, San Benito, and Merced Counties, 2015

County	2015 Usage (millions of kilowatt hours/year)	2015 Usage (1,000 MMBtu/year)
Santa Clara	16,812	57,365
San Benito	368	1,256
Merced	2,927	9,987
Total regional consumption	20,107	68,608
Total statewide consumption	283,000	965,636,000

Source: CEC 2016a, 2016b
Numbers are rounded
MMBtu = million British thermal units

The highest electric power requirement during a specified period, known as peak demand, is measured as the amount of electricity consumed at any given moment, usually integrated over a 1-hour period. Because electricity must be generated at the instant it is consumed, this measurement specifies the greatest generating capacity that must be available during periods of peak demand. Peak demand is important in evaluating system reliability, identifying congestion points on the electrical grid, and designing required system upgrades. California's peak demand typically occurs in August, between 3 p.m. and 5 p.m. (Cal-ISO 2016a). In the energy RSA, high air conditioning loads contribute to the summer peak demand.

Generation

The projected net power supply[4] within the grid controlled by the California-ISO for summer 2015 was 65,288 MW (Cal-ISO 2015). Table 3.6-9 summarizes fuel sources for electric power in California for 2015. California annual in-state electric power generation was 196,195 gigawatt hours (GWh) in 2015 (CEC 2016a).

[4] The projected net power supply is defined as the maximum generating capacity of a unit during typical seasonal peak conditions, minus the unit's capability used for station service or auxiliaries (Cal-ISO 2015).

Table 3.6-9 Fuel Sources for Electric Power in California in 2015

Fuel Type	California In-State Generation (GWh)	Percent of California In-State Generation
Coal	538	0.3
Large Hydro	11,569	5.9
Natural Gas	117,490	59.9
Nuclear	18,525	9.4
Oil	54	0
Other	14	0
Biomass	6,362	3.2
Geothermal	11,994	6.1
Small Hydro[1]	2,423	1.2
Solar	15,046	7.7
Wind	12,867	6.2
Total Electric Industry	**196,195**	**100**

Source: CEC 2016a
Data as of July 11, 2016, from Quarterly Fuel and Energy Reports and SB 1305 Reporting Requirements. In-state generation is reported generation from units 1 MW and larger
Totals may not sum due to rounding.
[1] Hydroelectric facilities smaller than 30 MW of generation capacity are considered "small" hydro and are part of the Renewables Portfolio Standard.
GWh = gigawatt hours
MW = megawatt

Electricity Market Outlook

Statewide, the average summer net power supply in 2015 was estimated at 65,288 MW and existing spring 2015 generation capacity was estimated at 54,044 MW for Cal-ISO (Cal-ISO 2015). Assuming 1-in-2 summer temperatures,[5] summer peak electricity demand was estimated at approximately 47,188 MW in 2015. The result is a predicted planning reserve margin[6] of 36 percent (Cal-ISO 2015). The Cal-ISO 2016 1-in-2 peak demand forecast is 47,529 MW, which is 0.8 percent above the 2015 weather normalized peak demand of 47,167 MW (Cal-ISO 2016c). California's population was 39.5 million as of January 1, 2017 (CDOF 2017), and is projected to exceed 42 million by 2025 and 47 million by 2040, requiring an additional 86,000 MW of peak summer capacity between 2017 and 2040[7] to meet the projected 2040 demand and have an adequate reserve margin (Cal-ISO 2015).

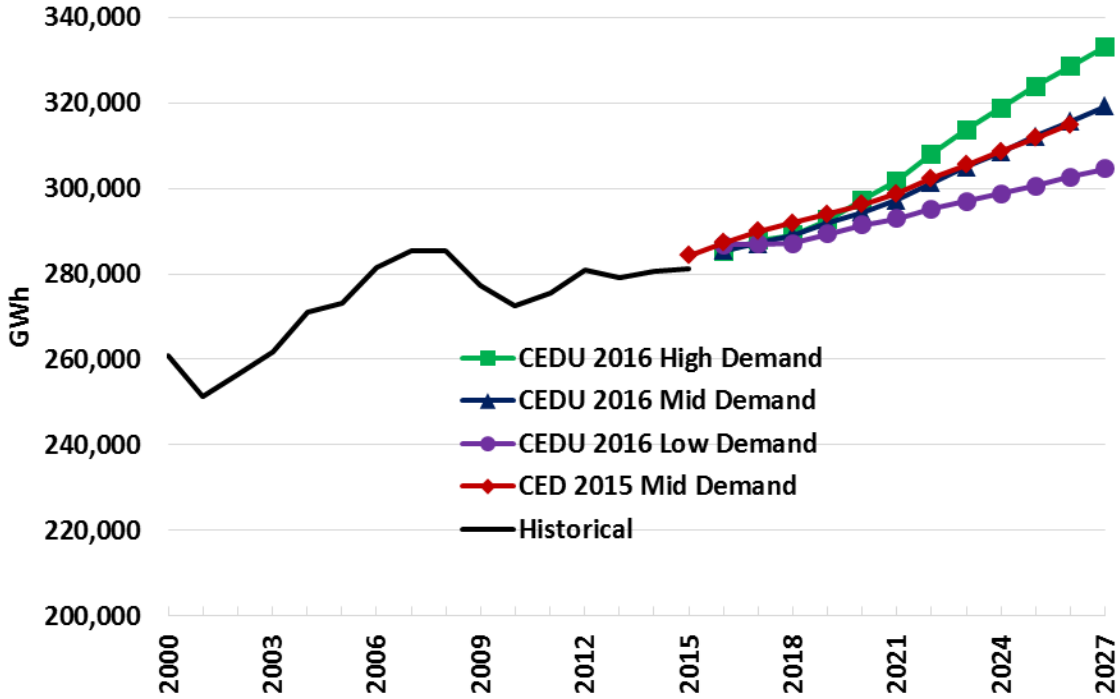
The CEC *California Energy Demand (CED) 2017–2027, Preliminary Electricity Forecast* (CEC 2017b) describes the CEC's preliminary 10-year forecasts for electricity consumption, retail sales, and peak demand for each of five major electricity planning areas and for the state as a whole. The CED considers three cases (low, mid, and high) based on different statewide economic growth and demographic growth assumptions that are designed to capture a reasonable range of statewide energy demand projection outcomes for 2017–2027:

- Low demand—The low energy demand case incorporates lower economic/demographic growth, higher assumed rates, and higher self-generation impacts.

[5] 1-in-2 forecast temperatures are temperatures with a 50 percent chance of not being exceeded.
[6] Planning reserve calculation = ((Total Net Supply + Demand Response + Interruptible Power)/1-in-2 Demand) – 1.
[7] This value assumes a 1.5 percent annual growth rate in peak demand and includes a 15 percent reserve margin.

- Mid demand—The mid energy demand case uses input assumptions at levels between the high demand and low demand cases. These scenarios are referred to as baseline cases, meaning they do not include additional achievable energy efficiency savings.
- High demand—The high energy demand case incorporates relatively high economic/demographic growth and climate change impacts, and relatively low electricity rates and self-generation impacts.

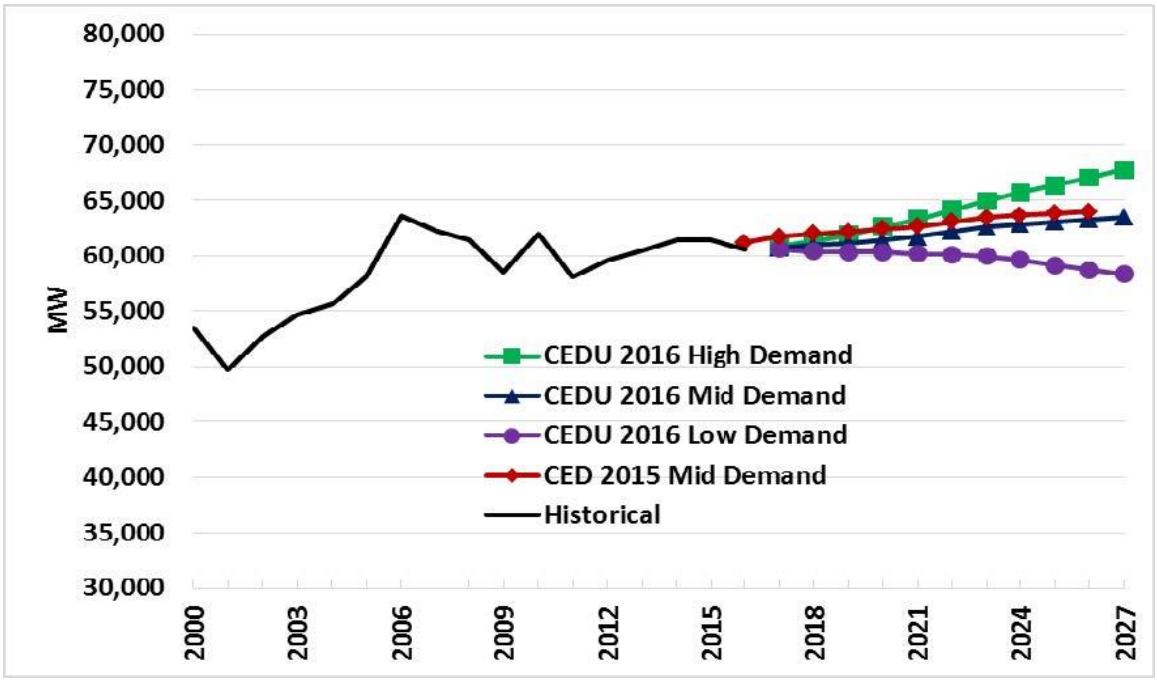
Figure 3.6-8 illustrates projected base demand electricity consumption for the three CED 2016 baseline cases. California electricity consumption in 2015 was approximately 280,000 GWh. Electricity consumption in 2027 is projected to be approximately 320,000 GWh for the mid demand case. Average annual projected base energy demand growth rates from 2015 to 2027 for the CED 2016 forecast averages are 1.4 percent, 1.1 percent, and 0.7 percent in the high energy demand, mid energy demand, and low energy demand cases, respectively, compared to a 0.93 percent projected energy demand growth rate in the CED 2015 mid demand case (CEC 2017c). The increasing demand for electrical energy is based on growth in both population (i.e., households) and commerce (i.e., commercial and industrial businesses). Weather can also influence electricity demand.



Source: CEC 2017b
CED = California Energy Demand (2015)
CEDU = California Energy Demand—Updated Forecast (2016)

Figure 3.6-8 Historical Trends and Projected Statewide Annual Electricity Consumption – Base Demand

Figure 3.6-9 illustrates projected peak electricity demand for the three CED 2016 baseline cases. California electricity peak demand in 2015 was approximately 60,000 MW. Peak electricity demand in 2027 is projected to be approximately 64,000 MW for the mid demand case. Annual projected statewide growth rates in peak demand from 2016 to 2027 for the CEDU 2016 cases shown in Figure 3.6-9 average 1.03 percent, 0.44 percent, and -0.30 percent in the high, mid, and low cases, respectively, compared to a 0.45 percent projected energy demand growth rate in the CED 2015 mid demand case (CEC 2017c).



Source: CEC 2017b
CED = California Energy Demand (2015)
CEDU = California Energy Demand—Updated Forecast (2016)

Figure 3.6-9 Historical Trends and Projected Statewide Annual Electricity Consumption – Peak Demand

Transmission

High-Voltage Electric Transmission Lines

The electrical power industry defines high-voltage electric transmission lines as those that are more than 100 kV.

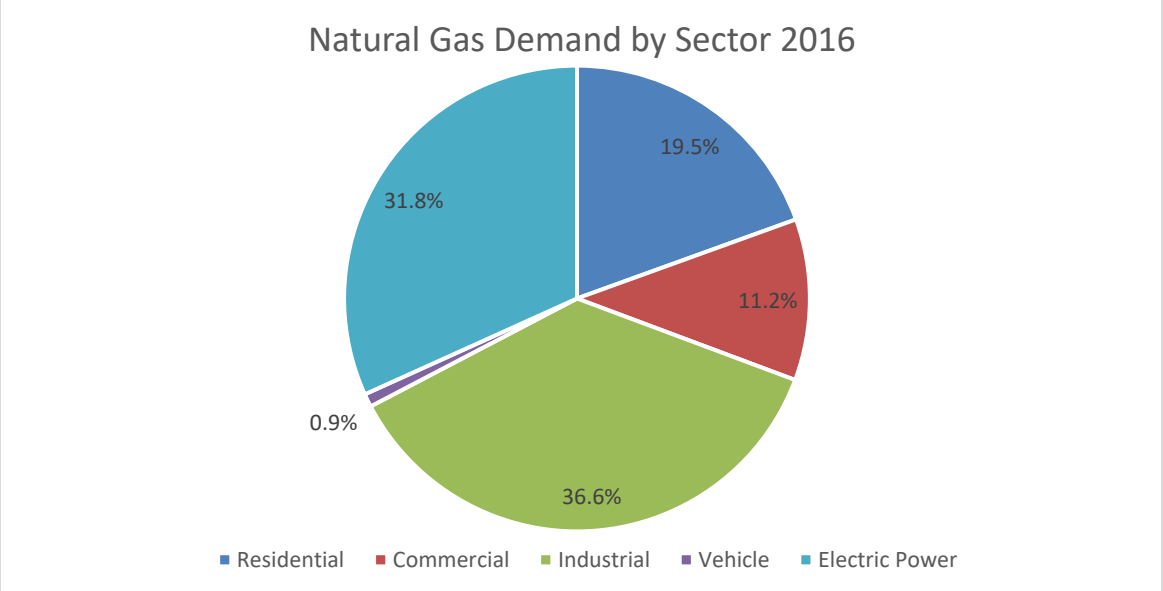
Cal-ISO operates approximately 26,000 miles of high-voltage electric transmission lines, which connect the different regions of the state to each other, to varying degrees, as well as to the transmission systems of the surrounding western states, Canada, and Mexico (Cal-ISO 2016b; FERC 2017). The system links generation to distribution in a complex electrical network that balances supply and demand on a nearly instantaneous basis. The degree to which areas are interconnected depends upon the availability of transmission capacity between the areas. These interconnected electric transmission systems allow power purchases and sales to extend beyond state and national borders. Cal-ISO, a nonprofit entity responsible for the system's reliability and nondiscriminatory transmission of energy, operates California's transmission system (Cal-ISO 2017a).

Long-term electric transmission planning identifies transmission upgrades needed to serve future loads, as well as to compensate for changes in generation patterns, such as the renewable power generation being introduced into the grid to meet RPS pursuant to state law (SB 350), requiring that 50 percent of retail sales of all utilities in the state come from renewable resources by the end of 2030 (Cal-ISO 2017b; CEC 2017d).

Natural Gas

Demand

California is the second largest consumer of natural gas in the nation, with consumption of 2,177,467 million cubic feet (MMcf) per year in 2016 (EIA 2017g). Natural gas is the most used fuel for electricity generation in California, and approximately 32 percent of this total daily consumption in 2016 was for electricity generation (EIA 2017b). Figure 3.6-10 illustrates the natural gas demand in California by sector for 2016.



Source: EIA 2017g

Figure 3.6-10 California Natural Gas Demand by Sector in 2016

The CEC expects natural gas consumption in California to increase by 0.75 percent annually between 2016 and 2028 for the high demand forecast case and to increase by 0.55 percent annually for the mid demand forecast case. Projected natural gas consumption in 2028 is 1,395,200 MMcf for the high demand case and 1,361,300 MMcf for the mid demand case, from 2016 natural gas consumption of 1,275,100 MMcf (CEC 2017e, 2017f). After implementation of the California RPS and full penetration of energy efficiency, CEC expects overall natural gas demand increases from population growth and associated demand, reaching 5.9 billion cubic feet (Bcf) per day by 2030 in the mid demand case. The projected total 2030 natural gas consumption would remain below the total 2015 consumption rate (CEC 2015). The CEC (2015) estimates for the Mid-Demand Case that the *total* natural gas consumption in units of MMcf/day will decrease from 6,334 MMcf/day in 2015 to 5,920 MMcf/day in 2030 as a result of energy efficiency measures.

Table 3.6-10 summarizes natural gas consumption in Santa Clara, San Benito, and Merced Counties in 2015 (CEC 2016c). The three counties used 47,500 MMcf of natural gas in 2015. Of that amount, 86.6 percent was consumed in Santa Clara County, 2.7 percent in San Benito County, and 10.7 percent in Merced County.

As shown in Figure 3.6-10, residential and commercial customers used 31 percent of natural gas consumed in California in 2016. Power plants generating electricity used 32 percent and the industrial sector used 37 percent. Transportation, primarily fleet vehicles, accounted for 1 percent of natural gas use in California in 2016 (EIA 2017g).

Table 3.6-10 Natural Gas Consumption in Santa Clara, San Benito, and Merced Counties in 2015

County	2015 Usage (millions of cubic feet)
Santa Clara County	41,100
San Benito County	1,300
Merced County	5,100

Source: CEC 2016a
Numbers are rounded.

Production

Natural gas marketed production in California in 2016 was 205,024 MMcf, accounting for 9.7 percent of 2016 in-state consumption of 2,113,847 MMcf (EIA 2017h, 2017i); out-of-state supply of natural gas to California in 2016 included Arizona (805,528 MMcf), Nevada (510,817 MMcf), and Oregon (680,979 MMcf) (EIA 2017j).

Updated Natural Gas Market Outlook

Although California's natural gas market is affected by nationwide price conditions, the state has taken steps to insulate itself from the full magnitude of the price-swing amplitudes. Since the height of the 2000–2001 energy crisis, California has built 2.2 Bcf of daily capacity to deliver natural gas supplies from Canada, the Rocky Mountains, and the Southwest, in addition to adding almost 1 Bcf of daily intrastate pipeline capacity. The State of California has also invested in underground storage capacity, an effective mechanism for controlling annual costs that will allow them to dampen the effect of future severe price increases by drawing on stored gas instead of buying high-priced natural gas on the open market.

Petroleum

Production

California produced 186 million barrels of crude oil in 2016 (EIA 2016a) and had proven crude oil reserves (including in-state offshore reserves) of 2,333 million barrels as of December 2015 (EIA 2016b). In 2016 approximately 600 million barrels (1.65 million barrels per day) of petroleum were processed into a variety of products, with gasoline representing about 62 percent of the total product volume. In 2016, approximately 16 percent of petroleum product production from California's refineries was aviation fuel, 20 percent was distillate fuel oil and 2 percent was residual fuel oil (CEC 2017g).

Imports

California imported approximately 316 million barrels of crude oil from foreign countries in 2016 and obtained approximately 69 million barrels of crude oil from Alaska (CEC 2017h, 2017i). The CEC reported in-state crude oil production and domestic crude oil imports of 205 million barrels for 2016; this value includes both crude oil produced in California and crude oil transported to California from the other lower 48 states including North Dakota and Gulf Coast states. Overall petroleum supply in 2016 in California was therefore approximately 590 million barrels of crude oil. Based on U.S. Energy Information Administration import data and CEC import data, California imported approximately 19 million barrels of crude oil from other lower 48 U.S. states (i.e., states other than Alaska) in 2016. Approximately 2.3 million barrels of crude oil were shipped to California by rail car in 2016; 50 percent of this total originated in Canada and another 50 percent originated in New Mexico (CEC 2017j).

Demand

Almost 40 percent of California's energy consumption results from the transport of goods and people. In 2015 sales of diesel fuel to California end users was approximately 1,093,000 gallons per day (gpd) and sales of gasoline to California end users was approximately 4,341,000 gpd

(approximately 16 billion gallons per year) (EIA 2017k, 2017l). The population in California is projected to increase by approximately 28 percent by the year 2040 from the population recorded in the 2010 Census. That growth equates to almost 10 million people (CDOF 2013). Because of trends in travel demand, congestion, and other travel conditions, the market for intercity travel in California that the proposed HSR system could serve is projected to grow by up to 46 percent from 2010 to 2040 (CDOF 2013).

Automobile travel is the predominant mode of passenger transportation within the energy RSA. Historically, demand for transportation services (and petroleum consumption) in California has mirrored the growth of the state's population and economic output. The recent trend toward electrical vehicles has generated renewed interest in more fuel-efficient cars and in living closer to the workplace. Although it is a slow process to transform an automobile fleet, drivers are increasingly making automobile purchasing decisions based on fuel consumption concerns. Automobiles powered by diesel engines and hybrid engines composed of both electrical and gasoline components offer substantial fuel-efficiency upgrades over traditional gasoline engines.

Rail and transit systems in the RSA include Caltrain, (Santa Clara) Valley Transportation Authority (VTA), BART, Altamont Corridor Express (ACE), and Amtrak. The BART and VTA systems are electric rail systems. The VTA provides light rail passenger rail service in Santa Clara County from Mountain View to Almaden and Santa Teresa including San Jose Diridon Station (VTA 2017). BART provides passenger rail transit service between downtown San Francisco and cities in the northern portion of the San Francisco Peninsula, Oakland, and other cities in the East Bay. BART and VTA are in the process of implementing an extension to Santa Clara that will include new BART stations in downtown San Jose, Diridon Station, and Santa Clara. The ACE provides passenger rail service between Stockton and San Jose and Santa Clara (ACE 2018). Amtrak Capitol Corridor and Coast Starlight routes provide passenger rail service to San Jose Diridon Station (Amtrak 2018). Caltrain provides passenger rail service from San Francisco to Gilroy through San Jose Diridon Station and Morgan Hill (Caltrain 2017). The Caltrain, Amtrak, and ACE systems are diesel locomotive systems. Caltrain reported consumption of approximately 4.3 million gallons of diesel fuel in 2015 (FRA 2015).

3.6.6 Environmental Consequences

3.6.6.1 Overview

This section discusses the potential impacts on public utilities and energy that could result from implementing the project alternatives. It is organized according to topic: public utilities, including electricity, natural gas, and petroleum fuels, water[8], wastewater, stormwater, and solid waste disposal; and energy resources, including electricity, natural gas, and petroleum fuels. Each topic area discusses potential impacts from the No Project Alternative and the project alternatives.

Overall, once construction is complete and passenger service is in operation, the HSR system would result in a net decrease in energy consumption for other modes of transportation as a result of reduction in VMT and airplane flights. Reduced transportation energy use would begin upon the start of passenger service and build over time to the 2040 horizon year for analysis. Further, the project would be constructed and operated in an energy-efficient manner. For example, the stations would qualify for Leadership in Energy and Environmental Design certification. The Authority has committed to powering the system on 100 percent renewable energy. To achieve this, the design would incorporate the means to produce or procure enough renewable energy to offset the amount of power used to operate the trains and facilities taken from the state's power grid. California has an abundance of renewable energy resources that have the capacity to substantially meet the state's RPS as well as the minimal demand of the HSR system. The RPS approved renewable sources include biomass, micro-hydro, geothermal, solar, and wind. Those not included were ocean thermal, wave, and tidal action. Initial findings from the Authority's call to industry are that a variety of companies have the capacity to supply the entire electricity needs of the system at full volume and are prepared and interested in

[8] The potential effects on water supply from tunneling are addressed in Section 3.8, Hydrology and Water Resources.

delivering that capacity. The next step would be to determine the final loads for initial operational segments, as well as the expected start date for testing and commissioning of systems. After that, the Authority would issue a request for proposals to meet its renewable energy demands.

3.6.6.2 Public Utilities

Construction of the project would result in temporary and permanent impacts on public utilities, including the temporary and permanent relocations of public utilities and reduction of access by public utility operators to public utilities remaining in the HSR right-of-way after construction is completed. Construction of the project would also result in planned and unplanned temporary interruptions of utility services to public utility customers. Operation of the project would result in permanent impacts on public utilities such as the ongoing use of water for operation of the stations and maintenance facilities, generation of wastewater and stormwater from operations, and generation of solid waste and hazardous waste from operations.

No Project Impacts

The population in Santa Clara, San Benito, and Merced Counties is expected to grow through 2040 (see Section 2.5.1.1, Projections Used in Planning). Development to accommodate the population increase under the No Project Alternative would result in associated direct and indirect impacts on public utilities. The No Project Alternative considers the effects of conditions forecasted by current land use and transportation plans in the vicinity of the project extent, including planned improvements to the highway, aviation, conventional passenger rail, freight rail, and port systems through the 2040 planning horizon. Without the HSR project, the forecasted population growth would increase pressure to expand highway and airport capacities. The Authority estimates that additional highway and airport projects (up to 4,300 highway lane miles, 115 airport gates, and 4 airport runways) would be needed to achieve equivalent capacity and relieve the increased pressure (Authority 2012a). Planned and other reasonably foreseeable projects that are anticipated to be built by 2040 include residential, commercial, industrial, recreational, transportation, and agricultural projects. A full list of anticipated future development projects is provided in Volume 2, Appendix 3.19-A, Nontransportation Plans and Projects, and Appendix 3.19-B, Transportation Plans and Projects.

Under the No Project Alternative, recent development trends are anticipated to continue, leading to impacts on public utilities. Existing land would be converted for residential, commercial, industrial, and transportation infrastructure development to accommodate future growth. These conversions would likely require demolition activities that could result in direct impacts on above ground and below-ground utilities, Furthermore, these conversions would place potential pressures on public utilities. Planned development and transportation projects that would occur under the No Project Alternative would likely include various forms of mitigation to address impacts on public utilities.

As discussed in Section 3.6.5, Affected Environment, local utilities prepare capital improvement plans to accommodate anticipated population growth. These improvements include utility service infrastructure additions and upgrades, including electricity generation, water conveyance, and waste management infrastructure. Several planned improvements within the public utilities RSA include a landfill expansion, a new solar energy facility, and two proposed water transfer agreements. The Panoche Valley Solar Farm Project, under construction in San Benito County, is a 247-MW solar energy generation facility that would increase electric generating capacity in the RSA and would deliver electricity to the regional transmission system by connecting to the PG&E Moss-Panoche/Coburn-Panoche 230-kV transmission line on the Panoche Valley facility site (County of San Benito 2015b; Panoche Valley Solar 2016).

Two water transfer agreements are proposed within the public utilities RSA. The Long-Term North to South Water Transfer Program would involve increased water transfers through the Delta using CVP or SWP pumps, or local facilities to CVP contractors in areas south of the Delta or in the San Francisco Bay Area (Bay Area) (SLDMWA 2015a). The 25-Year Water Transfer Program for the San Joaquin River Exchange Contractors Water Authority involves a proposed water transfer agreement with the SLDMWA that would make available up to 80,000 acre-feet of

water conserved through tailwater recapture[9] or other conservation measures to transfer for use by certain members of the SLDMWA for irrigation, municipal, and industrial purposes, providing additional recaptured water capacity for irrigation and other uses in Merced County (SLDMWA 2015b).

Project Impacts

Construction Impacts

Construction of the project would include demolition of existing structures; clearing and grubbing; handling, storing, hauling, excavating, and placing fill; and construction of aerial structures, bridges, tunnels, HSR electrical systems, and railbeds. Construction would also require utility network upgrades and reconductoring of electric utility lines, removal of utility lines from the proposed project's rights-of-way, and temporary and permanent utility relocations from the proposed project's rights-of-way that could include temporary interruption of utility services to customers. Construction activities would require water for preparation of concrete, TBM operations, concrete work and earthwork, controlling dust and supplying street-cleaning equipment, and also for landscaping and reseeding of areas temporarily disturbed by construction. Construction would generate wastewater, stormwater, solid waste (including C&D debris) and hazardous waste that would need to be managed by local and regional water and waste management infrastructure. Chapter 2, Alternatives, describes construction activities in more detail.

Impact PUE#1: Planned and Accidental Temporary Interruption of Utility Service

Planned, or accidental, temporary interruption of major utility service to public utility customers could occur during construction at any given location under all four project alternatives. Construction in the right-of-way that would occur for each of the alternatives, including clearing, grading and excavation, demolition of structures, and operation of cranes and other construction equipment could require the temporary shutdown of aboveground, below-ground, or overhead electrical transmission lines; natural gas transmission pipeline facilities; petroleum product conveyance facilities; and water conveyance infrastructure. Shutdowns would interrupt utility services to industrial, commercial, agricultural, and residential customers. As shown in Table 3.6-3, Alternative 2 has the greatest potential for planned temporary interruption of utility services due to the alignment's proximity to 402 major public utilities in the RSA. Alternative 1 has 297 public utility lines in the RSA, and Alternative 4 has 417 public utility lines in the RSA. Alternative 3 has the lowest potential for temporary interruption of utility services with 272 public utility lines in the RSA. In addition, construction activities could result in the accidental temporary interruption of utility lines (e.g., electricity, potable water, recycled water, wastewater, natural gas lines) that were not identified through the preliminary reconnaissance. Construction activities would be similar for the four project alternatives and the level of existing development is similar in the RSAs, resulting in similar potential for accidental temporary impacts on unknown utilities. These disruptions could interrupt utility services to industrial, commercial, and residential customers.

Established practices of utility identification, which would be completed prior to construction, would minimize the potential for accidental disruption. Regulations require development of a construction safety management plan and a safety and security management plan that include identification and mapping of buried and overhead utility lines. The contractor will coordinate with utility service providers and local government agencies to identify and map the locations of underground utilities prior to construction and will establish safety and response procedures in the event that a previously unidentified or unmapped underground utility is identified during construction (SS-IAMF#2: Safety and Security Management Plan). In compliance with California law (California Government Code § 4216), the construction contractor would use a utility locator service and manually probe for buried utility lines within the project footprint prior to initiating

[9] Tailwater is water running off of the lower end of an irrigated field. Tailwater recapture systems capture the tailwater and reuse the tailwater for irrigation (UCANR 2007).

ground-disturbing activities. Once buried utilities are identified, excavators would be required to physically mark with white paint or other suitable markings their location in the area to be excavated. Overhead utility lines would be identified and safety zones established prior to operation of cranes or other overhead equipment that could contact overhead lines. These procedures would minimize the potential for accidental interruption of utility service through construction-related damage to utility lines.

New utility infrastructure would also be built to support construction and operation of the project. Network upgrades required to support this project include the reconductoring of three existing 115-kV power lines and construction of three traction power substations (TPSS) and electrical interconnections. Construction associated with the reconductoring of the electric transmission lines and the electrical interconnection facilities to connect the project to the electrical grid would require the temporary shutdown of electric utilities, which may result in the temporary interruption of utility services to customers.

Although construction of all four project alternatives would result in planned temporary interruption of utility service, project features will minimize the planned disruption of utility services. Prior to construction in areas where utility service interruptions are unavoidable, the contractor will notify the public through a combination of communication media (e.g., phone, email, mail, newspaper notices, or other means) within that jurisdiction and will notify the affected utility service providers of the planned outage (PUE-IAMF#3: Public Notifications). The change in alignment under Alternative 4 with the DDV may affect additional buried utilities, but, with implementation of PUE-IAMF#3, the construction contractor would coordinate with utility providers to minimize and manage any temporary utility disruption and there would be no change in utility impacts compared to Alternative 4 without the DDV. The public notifications would specify the estimated duration of the planned outage and would be published no less than 7 days prior to the scheduled outage, in accordance with Cal-ISO requirements (Cal-ISO 2015). Construction would be coordinated with utility service providers and utility customers to avoid interruptions of utility service to hospitals and other critical users. In addition, prior to construction the contractor will prepare a technical memorandum documenting how construction activities will be coordinated with utility service providers to minimize or avoid interruptions of utility service (PUE-IAMF#4: Utilities and Energy). When relocating an irrigation facility will be necessary, the contractor will verify that the new irrigation facility is installed and operational prior to disconnecting the original facility, where feasible (PUE-IAMF#2: Irrigation Facility Relocation) to minimize interruption of irrigation service to customers. The contractor's design-build contract would include irrigation facility relocation preferences, and implementation of these relocation preferences would minimize unnecessary impacts on irrigation customers and would support continued operation of irrigation facilities.

CEQA Conclusion

There would be a less than significant impact under CEQA from planned and accidental temporary interruption of utility service during construction for any of the project alternatives. Temporary interruption of utilities would be limited to short durations during construction, and therefore would not require the expansion of existing or construction of new infrastructure that would result in significant environmental effects. Project features will effectively minimize utility interruptions by requiring coordination with service providers in advance, notifying the public and affected service providers of any planned outages, and verifying that new facilities are operational prior to disconnecting the original facility. Temporary planned and accidental utility conflicts associated with the alternatives will not require temporary relocation of nonlinear fixed facilities that will result in significant environmental effect; the planned temporary reconstruction or relocation of major linear non-fixed facilities during project construction will be conducted in accordance with the construction safety management plan and safety and security management plan for the project (SS-IAMF#2) and will therefore not result in lengthy or harmful interruption of service. Accidental interruptions might still occur but would be of short duration and could be managed in accordance with these project features. Thus, the impact from planned and accidental utility conflicts would be less than significant under CEQA. Therefore, CEQA does not require mitigation.

Impact PUE#2: Temporary Impacts from Water Use

Construction of the project would require water to prepare concrete, increase the water content of soil to optimize compaction, clean equipment, control dust, and reseed disturbed areas; operate TBMs; and conduct drilling and other ground excavation activities. Table 3.6-11 shows the estimated water use for construction of the project. Water used during construction activities would be obtained from existing, permitted commercial sources of potable water, recycled water, and groundwater in Santa Clara, San Benito, and Merced Counties.

Table 3.6-11 Construction Water Use by Alternative and Activity

Length of Construction	Construction Activity	Water Use	
		Annual Construction Use (acre-feet/year)	Total 5-Year Construction Use Acre-Feet
Alternative 1			
89.6 miles	Concrete batch plants (tunnel)	17	83
	Concrete batch plants (alignment)	57	285
	Tunnel boring[1]	366	1,829
	Construction water use[2]	428	2,141
	Total	**868**	**4,339**
Alternative 2			
89.3 miles	Concrete batch plants (tunnel)	17	83
	Concrete batch plants (alignment)	60	300
	Tunnel boring	366	1,829
	Construction water use[2]	399	1,993
	Total	**842**	**4,205**
Alternative 3			
88.1 miles	Concrete batch plants (tunnel)	17	83
	Concrete batch plants (alignment)	61	304
	Tunnel boring	366	1,829
	Construction water use[2]	468	2,339
	Total	**912**	**4,555**
Alternative 4			
88.9 miles	Concrete batch plants (tunnel)	17	83
	Concrete batch plants (alignment)	51	253
	Tunnel boring	366	1,829
	Construction water use[2]	453	2,261
	Total	**887**	**4,426**

Source: Tung 2017; Authority 2018a

[1] Annualized water use is based on a total of 784 working days of tunnel boring machine operation.

[2] Construction water use includes water used for on-site concrete work, earthwork, dust control, and landscaping.

The difference in construction water use between the alternatives is a function of the total guideway length and the type of construction (e.g., at-grade, aerial, tunnel), which vary by alternative. The type of construction affects the amount of concrete work and earthwork construction required, which require differing amounts of water. Alternative 2 would use 4,205 acre-feet of water during construction, compared to 4,339 acre-feet for Alternative 1, 4,555 acre-feet for Alternative 3, and 4,426 acre-feet for Alternative 4.

Tunnel boring activities would range from 40 to 43 percent of the total construction water use, depending on alternative. All four project alternatives would require the construction of bored tunnels through the Pacheco Pass. The specific type of TBM used for construction would be determined as part of the tunnel design process, however it is anticipated that the selected TBMs would require cooling with recirculated water during operation. The Authority has estimated that each TBM operating from each twin tunnel portal would require a total of 1,829 acre-feet (366 acre-feet per year) for maintenance and cleaning of the excavated sections of the tunnel; operation of conveyor belts and hoppers; dust control and vehicles/engine wash down; operation of tunnel excavation-area workshops; and potable water for construction workers. Water used for tunnel construction would be obtained from surface water or groundwater sources. The construction contractor would recycle and reuse water on-site to reduce water consumption for construction of the tunnels.

Water usage for electrical reconductoring would generally be limited to dust suppression associated with construction activities. Construction associated with the Spring to Llagas and Green Valley to Llagas 115-kV power lines would require approximately 9,080 gallons of water (<0.001 percent of the total construction water usage) over the entire construction period. PG&E would obtain water from existing municipal supplies. Construction vehicles would transport potable water for construction personnel to the construction site.

A variety of water sources would be available from water suppliers within the RSA to provide water for construction-related activities. The largest water suppliers in the RSA are SCVWD in Santa Clara and SBCWD in San Benito County. A number of water districts and agencies serve Merced County and obtain their water from CVP and SWP surface waters. When available, reclaimed nonpotable water would be used for dust control, tunnel construction, and landscaping. This water would be obtained from private vendors, delivered in trucks, and stored in tanks that could be moved around to construction work sites. This use would not result in increased long-term demand on local potable water supplies. For other construction water uses for which potable water is required, water conservation design features would be implemented. The design-build contractor would prepare a water conservation plan (Authority 2015) that clearly describes how water conservation would be incorporated in the design and construction of the project. Water use during construction would be in compliance with the Authority's Water Conservation Guidance (Authority 2015).

As shown in Table 3.6-12, existing water use for the land within the project footprints of the project alternatives, primarily for agriculture, is 8,704 to 9,525 acre-feet/year, using both surface water and groundwater. Depending on the alternative selected, annual water use for construction would range from 842 to 912 acre-feet/year, or about 9 to 10 percent of the current water usage for the land within the project footprints. Alternative 3 would require the greatest amount of water for construction (912 acre-feet/year), followed by Alternative 4 (887 acre-feet/year) and Alternative 1 (868 acre-feet/year); Alternative 2 would require the least amount of water for construction (842 acre-feet/year). Table 3.6-12 provides a summary of annual construction use by alternative as compared to estimated water consumption for existing land uses.

Table 3.6-12 Annual Construction Water Use Summary by Alternative

County	Annual Water Use (acre-feet per year)		
	Existing Use	Construction Use	Percent of Existing Use
Alternative 1			
Santa Clara County	4,043	494	12
San Benito County	1,729	22	1
Merced County	2,931	351	12
Total	**8,704**	**868**	**10**
Alternative 2			
Santa Clara County	4,799	477	10
San Benito County	1,811	21	1
Merced County	2,915	343	12
Total	**9,525**	**842**	**9**
Alternative 3			
Santa Clara County	4,241	512	12
San Benito County	1,844	31	2
Merced County	2,931	369	13
Total	**9,016**	**912**	**10**
Alternative 4			
Santa Clara County	4,172	497	12
San Benito County	1,714	30	2
Merced County	2,931	361	12
Total	**8,817**	**887**	**10**

Sources: City of Santa Clara 2010; City of San Jose 2018c; County of Santa Clara 1994, 2016; City of Morgan Hill 2016a; City of Gilroy 2002, 2005; County of Merced 2013; County of San Benito 2016a, 2016b; City of Fresno 2008; DWR 2005, 2006, 2007, 2008, 2009, 2010; Authority 2018a.

Construction of the project would occur between 2022 and 2027. The SCVWD projected normal year water supply for 2025 exceeds projected 2025 water demand by 36,800 acre-feet. The estimated project construction water consumption in Santa Clara County (Table 3.6-12) is approximately 11 percent of the surplus supply projected by the SCVWD. The SBCWD projected normal year water supply for 2025 exceeds projected 2025 water demand by 3.683 acre-feet. The estimated project construction water consumption in San Benito County (Table 3.6-12) is approximately 0.6 percent of the surplus supply projected by the SBCWD. Construction of the project in Merced County would occur in the SLDMWA Westside-San Joaquin region and adjacent water management regions. Surface water in the SLDMWA region is supplied primarily from the CVP. Groundwater is also used in the region for both municipal and industrial and agricultural purposes; groundwater supplies in the region would be managed in accordance with the applicable groundwater sustainability plans, once developed (SLDMWA 2019). Conversion of agricultural land within the project footprints in Merced County, and also in Santa Clara County and San Benito County, would reduce water consumption because the land would no longer be used for agricultural purposes, and water allocated to the agricultural land for irrigation would no longer be used.

Table 3.6-12 summarizes annual construction water use by alternative and summarizes the potential reduction in water use from construction of the alternatives. The Authority estimated this potential reduction in water use by assuming that agricultural land taken out of agricultural production for construction of the alternatives would no longer consume water for irrigation or other purposes. The Authority assumed that water allocated to agricultural land taken out of agricultural production would no longer be used and that the water would not be reallocated for use elsewhere. Based on these assumptions, the average annual water use over the construction period for the project alternatives would be about 90 percent less than existing water use within the project footprints because of the temporary and permanent removal of agricultural land from production.

However, although the Authority has assumed that water would not be reallocated within Reclamation's service area, reallocation would depend on the locations and water district landowners affected. CVP contractors south of the Delta often do not receive their full allocations of water due to hydrologic and environmental requirements, and water is likely to be reallocated to these contractors. Therefore, the Authority's estimate of 90 percent reduction in water consumption from construction of the alternatives represents an upper bound estimate; the reduction could be substantially lower depending on whether and to what extent water use from lands taken out of agricultural production is reallocated.

Because the water use within the footprints for construction of the project alternatives would be lower relative to existing water use for agricultural activities within the same area, sufficient water supplies would be available to serve construction of the project alternatives and reasonably foreseeable future development during normal, dry, and multiple dry years. Information regarding existing water use and anticipated water use for each of the project alternatives is summarized in Appendix 3.6-C.

CEQA Conclusion

There would be a less than significant impact under CEQA from temporary water use during project construction because the project avoids and minimizes water use and there is sufficient projected surplus in water supplies (including in Santa Clara County). Through implementation of a water conservation plan and compliance with the Authority's Water Conservation Guidance (Authority 2015), project features (including water conservation and use of nonpotable and recycled water for construction activities) will minimize water use during construction. The project would result in a temporary increase in water use; however, this increase would be small relative to existing demand. Furthermore, as shown in Table 3.6-12, annual construction water use would be approximately 9 to 10 percent of existing water use for each of the alternatives, assuming that water for lands taken out of agricultural production is not reallocated. Thus, there is sufficient water supply to accommodate the construction water use and reasonably foreseeable future development during normal, dry, and multiple dry years. As a result, the impact on water supplies from construction water use would be less than significant under CEQA. Therefore, CEQA does not require mitigation.

Impact PUE#3: Reduced Access to Existing Utilities in the HSR Right-of-Way

Appendix 3.6-A in Volume 2 identifies existing utilities within the right-of-way. These utilities include electric transmission towers, electric power lines, electric substations, fiber optic and telecommunication lines, potable water and recycled water lines, water conveyance structures, natural gas and petroleum product pipelines, and wastewater and stormwater lines.

Table 3.6-13 shows the number of major utility lines that would need to be permanently relocated or protected in place or that would be removed, extended, abandoned in place, or realigned during construction under each project alternative. Alternative 4 would result in the most (404) utility conflicts and would result in the most (165) utilities protected in place and remaining within the right-of-way, while Alternative 3 would result in the fewest (202) utility conflicts and the fewest utilities (45) protected in place. Alternative 1 would result in 212 utility conflicts and 46 utilities protected in place. Alternative 2 would result in 303 utility conflicts and 61 utilities protected in place.

Table 3.6-13 Major Utility Conflicts and New Utility Installations

Alternative	Relocate	Protect in Place	New Installation	Removed	Extend	Abandon	Realign	Total Utility Conflicts
Alternative 1	158	46	39	1	2	1	4	**212**
Alternative 2	235	61	69	0	2	1	4	**303**
Alternative 3	150	45	39	0	1	2	4	**202**
Alternative 4	176	165	46	4	5	2	6	**404**

Source: Authority 2019
These are estimates of the total number of conflicts, and do not double-count electrical facilities that, for instance, jointly locate electrical utility lines and telecommunications lines. As a result, these totals differ from Table 3.6-3

Construction of the project would require that the right-of-way be permanently fenced and secured to prevent unauthorized access to the right-of-way. Any underground utilities that conflict with the HSR right-of-way either would be relocated or would be reinforced underneath the HSR right-of-way inside a casing pipe that is strong enough to carry the HSR facilities and that would allow for utility maintenance access from outside the HSR right-of-way. For those utilities remaining within the right-of-way after completion of construction and protected in place, maintenance access by utility owners would be limited. For this reason, utility lines that would require routine maintenance by utility service providers would be removed or relocated and would not remain within the HSR right-of-way after completion of construction. The four project alternatives would be in similar geographic locations with similar proximity to major utilities and would be permanently fenced and secured, which would result in similar controlled access to utilities within the HSR right-of-way.

It is common practice that utility districts coordinate and schedule in advance any field visits to their facilities with the owner of the property within which their facilities lie. Thus, the procedure for utility districts to access existing utilities remaining within the right-of-way would be similar to existing practices. The alternatives would not reduce access to existing utilities in the HSR right-of-way because utilities would be relocated or protected in place such that utilities would be accessed from outside of the fenced HSR right-of-way.

CEQA Conclusion

There would be a less than significant impact under CEQA for access to utilities remaining in the right-of-way after completion of construction, because utility service levels would remain unchanged after construction work is completed and the continued ability of utility services providers to access to utilities after completion of construction would maintain the existing level of utility services. Construction of new utility facilities and expansion and upgrade of existing utility facilities is part of the project. Utilities and service systems would be temporarily affected typically only during a brief relocation period. Construction work that could result in temporary interruption of utility services would be conducted in coordination with the utility provider and with prior public notification, and utility service levels would remain unchanged after construction work is completed. Reduced access to existing facilities would not result in the need for additional new utility facilities or the expansion or upgrade of existing utility facilities beyond that already identified and assessed. The alternatives would not reduce access to existing utilities in the HSR right-of-way because existing major utilities within the HSR right-of-way would be relocated or protected in place such that maintenance of relocated utilities could occur outside the HSR right-of-way and utility owners would still be able to access any existing utilities protected in place and remaining within the HSR right-of-way. Project features include effective measures to address utility owners' access needs; these measures will protect and maintain continued controlled access to utility lines remaining within the right-of-way during and after construction by coordinating and scheduling utility service provider field visits with the property owner in advance. Thus, the alternatives would not result in the construction or expansion of electrical facilities; the relocation of nonlinear fixed facilities; or the reconstruction or relocation of a major linear non-

fixed facility, that would cause significant environmental impacts. The alternatives would not result in lengthy and harmful interruption of service due to reduced access or require or result in the construction of new utility facilities or expansion and upgrade of existing utility facilities that could cause significant environmental effects. Thus, the impact from reduced access would be less than significant under CEQA. Therefore, CEQA does not require mitigation.

Impact PUE#4: Existing Major Utilities Requiring Relocation or Removal

The project alternatives would require excavation to support construction of various HSR facilities including elevated structures, railbeds, below-ground tracks, or tunnels. During excavation activities, buried utility lines (including water supply pipelines, natural gas, fuel, communication, and sanitary sewer lines, storm drains, and electrical lines) may be uncovered, which could result in conflicts with existing major utilities during construction because major utilities may need to be permanently relocated as a result of construction. In addition, conflicts could result from existing surface structures, including electrical substations and water conveyance facilities, groundwater well and pump stations, aboveground or overhead electric lines, transmission towers, communication lines, and other major utilities because the utilities may need to be permanently relocated or permanently removed as a result of construction.

Alternative 2 and Alternative 4 would require the relocation of the Diana Well south of the cul-de-sac at the end of the Diana Avenue in Morgan Hill. For Alternative 2, the well would be shifted east in relation to the proposed Diana Avenue cul-de-sac. Relocation under Alternative 4 would occur within the existing Caltrain right-of-way on the north side of the Diana Avenue cul-de-sac.

Appendix 3.6-A in Volume 2 identifies the owner/operators, types, and locations of major utilities that would need to be permanently relocated for construction of the project, and utilities that would be removed, extended, abandoned in place, or realigned for construction of the project. Table 3.6-13 summarizes the number of major utility lines that would need to be permanently relocated, or removed, extended, abandoned in place, or realigned during construction of each project alternative. Alternative 2 would result in the most (235) utility relocations, while Alternative 3 would result in the fewest (150) utility relocations. Alternative 1 would result in 158 utility relocations and Alternative 4 would result in 176 utility relocations. In addition, under Alternative 2, the need to depress roadways to grade-separate the HSR alignment along Monterey Road may require the installation of pump stations to maintain current functions of gravity-driven utility lines such as storm drains and sanitary sewers within those roadway rights-of-way. Construction of Alternative 1 and Alternative 2 would necessitate the acquisition of three percolation ponds (51 acres) in southern Gilroy that are currently owned and operated by the SCRWA WWTP. These are shallow earthen diked ponds, about 5–8 feet deep (berm height) with sloped sides, and unpaved service roads extending between them. These facilities are part of the groundwater recharge facilities associated with SCVWD's *Groundwater Management Plan* for the Llagas groundwater subbasin (SCVWD 2016b). As described under Section 3.6.5.1, Public Utilities, these ponds first percolate secondary treated effluent from the WWTP, which is then piped through a distribution network. Construction of Alternatives 1 and 2 would also require closure of two of the groundwater monitoring wells that are included in the SCRWA WWTP's groundwater monitoring plan and that monitor the three percolation ponds that would be acquired and closed. Because the ponds would be closed, the groundwater wells that currently monitor the ponds would no longer be needed. Acquisition of land for construction of Alternatives 1 and 2 would reduce the capacity of the percolation ponds and has the potential to affect the wastewater treatment capacity of the facility.

Pursuant to utility agreements negotiated between the Authority and the utility service providers, the Authority would work with utility owners during final engineering design and construction of the project to relocate utility lines to outside of the right-of-way, abandon the utility lines in place within the right-of-way, or protect the utility lines in place within the right-of-way. Where overhead distribution lines cross the alignment, the Authority and the utility service provider may decide to place the line below-ground and protect the line in place to avoid potential conflict with HSR operations. Utility lines that would need to be relocated to outside of the right-of-way would be replaced or reinstalled in cooperation with utility service providers so as not to permanently affect

utility services to customers. Relocations and reinstallation of utility lines would be conducted by the contractor in cooperation with the utility service providers in accordance with design standard and regulatory requirements including CPUC General Order 131-D for electrical systems. General Order 131-D requires electric utility service providers to obtain PTCs for construction of electric power lines or substations designed for operation between 50 kV and 200 kV or construction of new or upgraded substations with high side voltage exceeding 50 kV. Minor relocation of existing power lines up to 2,000 feet in length and conversion of overhead utilities to below-ground utilities are exempt from General Order 131-D PTC requirements.

Where relocating an irrigation facility is necessary, the contractor will verify that the new facility is operational prior to disconnecting the original facility, where feasible (PUE-IAMF#2). Irrigation facility relocation preferences are included in the design-build contract and reduce unnecessary impacts on continued operation of irrigation facilities. Any new or relocated utility facilities would be located within existing utility or road rights-of-way to the extent feasible. Where water agency irrigation systems run parallel to the alignment and would fall within the project footprint, the Authority would acquire land required to relocate the parallel segments outside and parallel to the permanent right-of-way, construct the new canal segment with replacement turnouts, tie-in the new segment during an outage period, and transfer the land and the facility to the water agency when the irrigation facility is rebuilt. Operating turnouts on existing canals would remain in service during the new facility construction period, which could require installation of temporary pumps and conduits. Other features such as ponding and storage areas may need to be relocated during construction. Replacement facilities would be designed and construction staged to allow operations to continue during construction of the project (Authority 2012b).

CEQA Conclusion

There would be a significant impact under CEQA for Alternatives 1 and 2 because acquisition of land currently in use for percolation ponds at SCRWA WWTP would permanently reduce the treatment capacity of this major fixed facility. This reduction in treatment capacity could result in a lengthy and harmful interruption of service to WWTP customers and in the potential need for relocating the percolation ponds to restore the treatment capacity. Mitigation Measures to address this impact are identified in Section 3.6.9, CEQA Significance Conclusions. Section 3.6.7, Mitigation Measures, describes these measures in detail.

Construction of Alternative 1 and Alternative 2 would not result in any other permanent conflicts with other major utilities because other existing electrical utilities and water utilities including potable water, irrigation and drainage systems, electrical transmission lines, electrical substations, and communications lines would be permanently relocated or protected in place through agreements between the Authority and utility service providers.

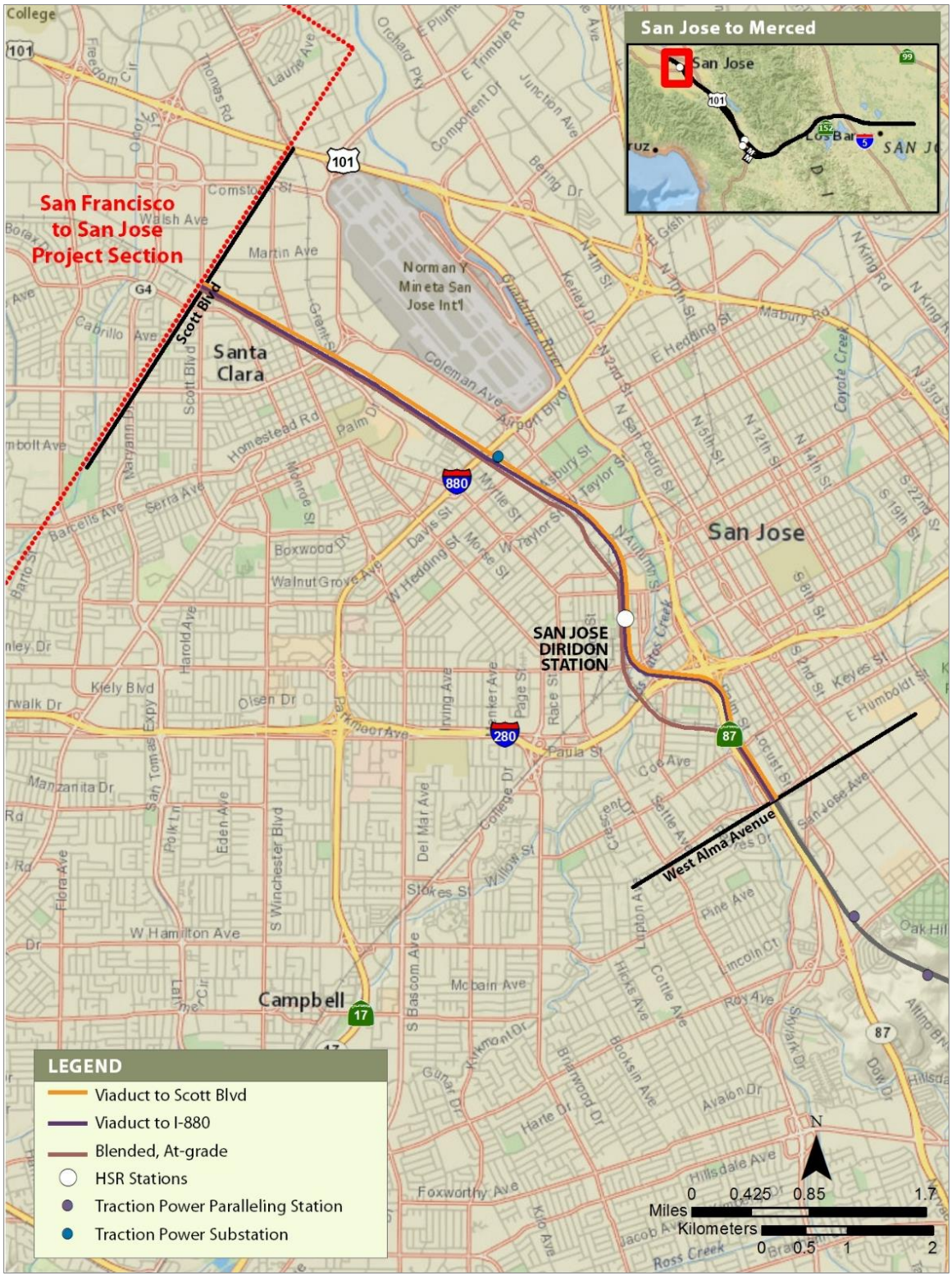
There would be a less than significant impact under CEQA for Alternative 3 and Alternative 4 associated with permanent conflicts with existing major utilities because Alternative 3 and Alternative 4 would not affect the SCRWA treatment facility, and because existing electrical utilities and water utilities including potable water, irrigation and drainage systems, electrical transmission lines, electrical substations, and communications lines would be permanently relocated or protected in place through agreements between the Authority and utility service providers.

All project alternatives would minimize permanent conflicts between major utilities because existing electrical utility lines and water utility lines including potable water, agricultural irrigation and drainage systems, electrical transmission lines, electrical substations, and communications lines would be permanently relocated or protected in place through agreements between the Authority and utility service providers. The contractor would conduct relocations and reinstallation of utility lines, in cooperation with the utility service provider, in accordance with design standards and regulatory requirements including CPUC General Order 131-D for electrical systems. Through effective coordination in the planning and implementation of major utilities relocations, conflicts between project construction and major linear non-fixed utilities would be minimized and would not result in lengthy and harmful interruption of service impacts on utility service providers or customers other than impacts on the SCRWA WWTP utility property for Alternative 1 and

Alternative 2. SCRWA WWTP services would not be interrupted as a result of construction; new service would be provided before existing service is taken offline.

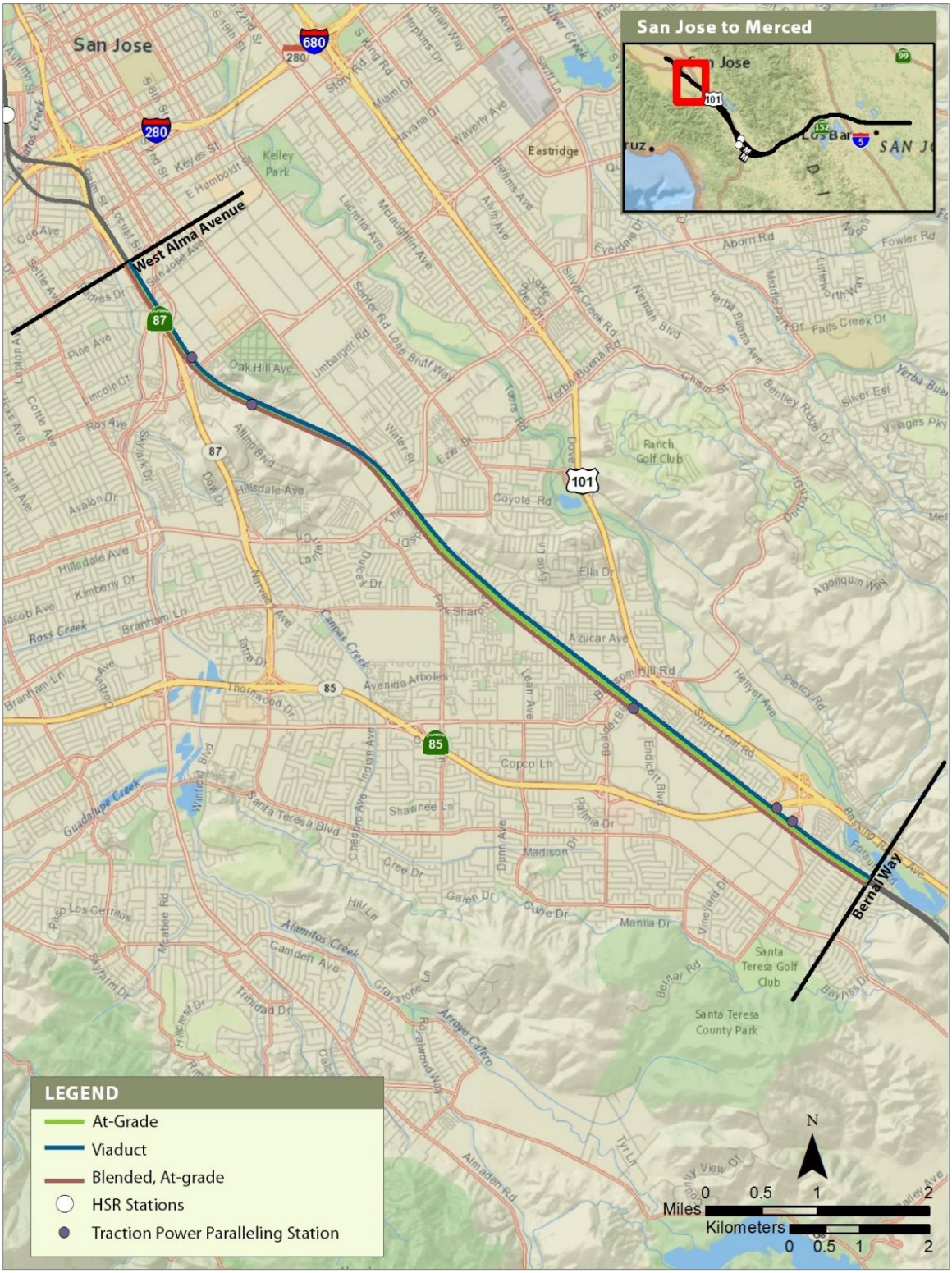
Impact PUE#5: Temporary Impacts from Construction of New Utility Infrastructure

The project would require construction of new utility infrastructure, including electrical infrastructure to power the HSR system, potable water and wastewater utility connections to serve the stations and maintenance facilities, and new stormwater management structures and drainage infrastructure. The electrical infrastructure components of the project include construction of three TPSSs, traction power switching stations, and traction power paralleling stations, traction power supply drops, and other electricity distribution infrastructure to provide electric power to the HSR. The locations of these proposed electrical components are depicted on Figure 3.6-11 through Figure 3.6-15 and detailed descriptions are provided in Chapter 2. Project construction would also involve the extension of below-ground or overhead power transmission lines connecting the TPSSs to either a new utility switching station or an existing PG&E switching station via a short section of 230-kV transmission or 115-kV power lines. Per Authority requirements, the interconnection points between the switching stations and the TPSS would be equipped with redundant transmission (i.e., double-circuit electrical lines) from the point of interconnection. All network upgrades would be implemented pursuant to CPUC General Order 131-D (Rules Relating to the Planning and Construction of Electric Generation, Transmission Power Distribution Line Facilities and Substations Located in California). Construction would result in installation of new major utilities in the right-of-way. Alternatives 1 and 3 would result in installation of 39 new major utilities; Alternative 2 would result in installation of 69 major utilities; and Alternative 4 would result in installation of 46 major utilities. The change in tunnel vertical alignment with the TDV would not affect any new utilities. TDV superelevation construction would not change effects on utilities compared to the alternatives without the TDV.



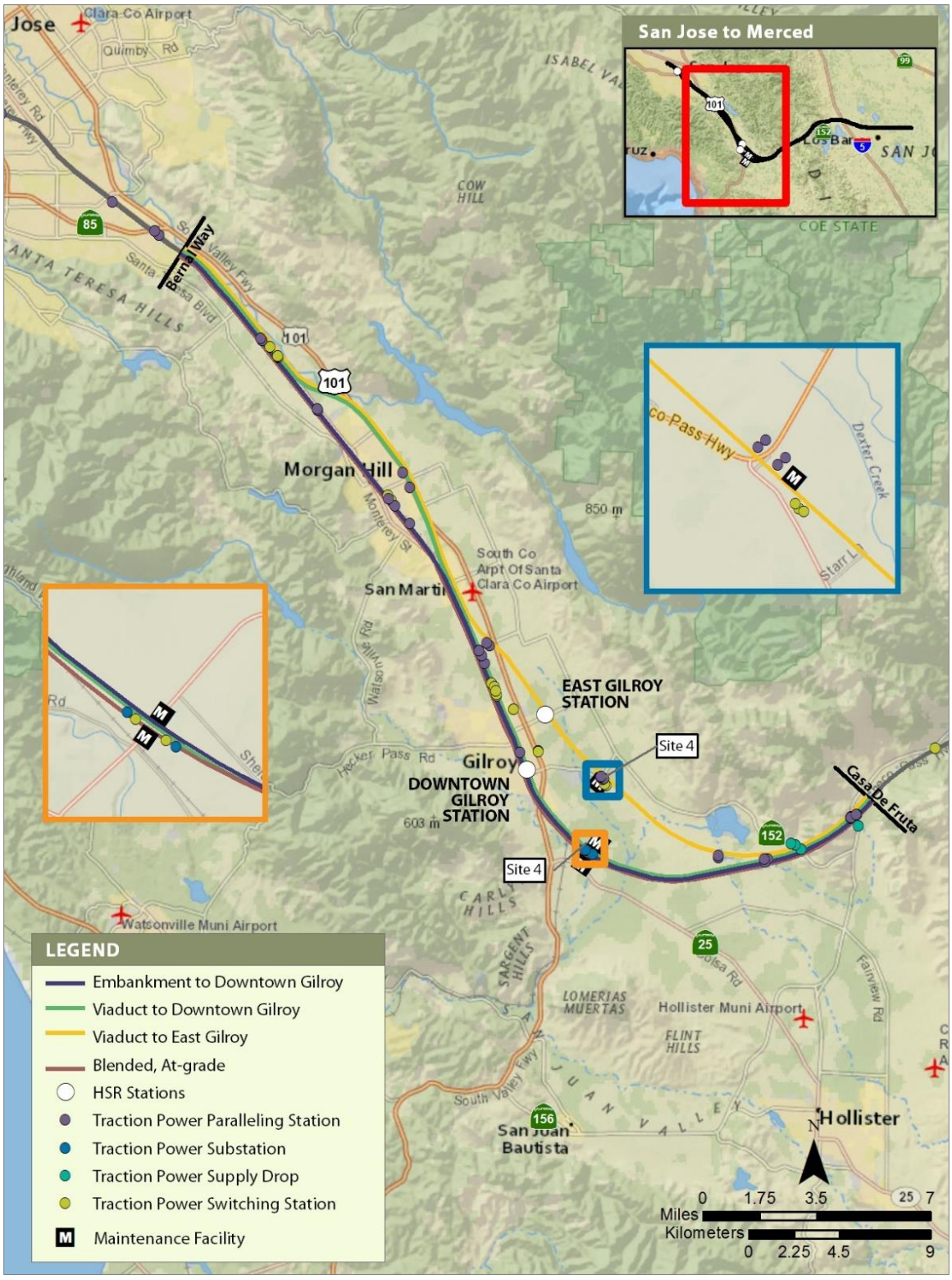
Source: Authority 2019 JULY 2019

Figure 3.6-11 Proposed HSR Electrical Components—San Jose Diridon Station Approach Subsection



Source: Authority 2019 JULY 2019

Figure 3.6-12 Proposed HSR Electrical Components—Monterey Corridor Subsection

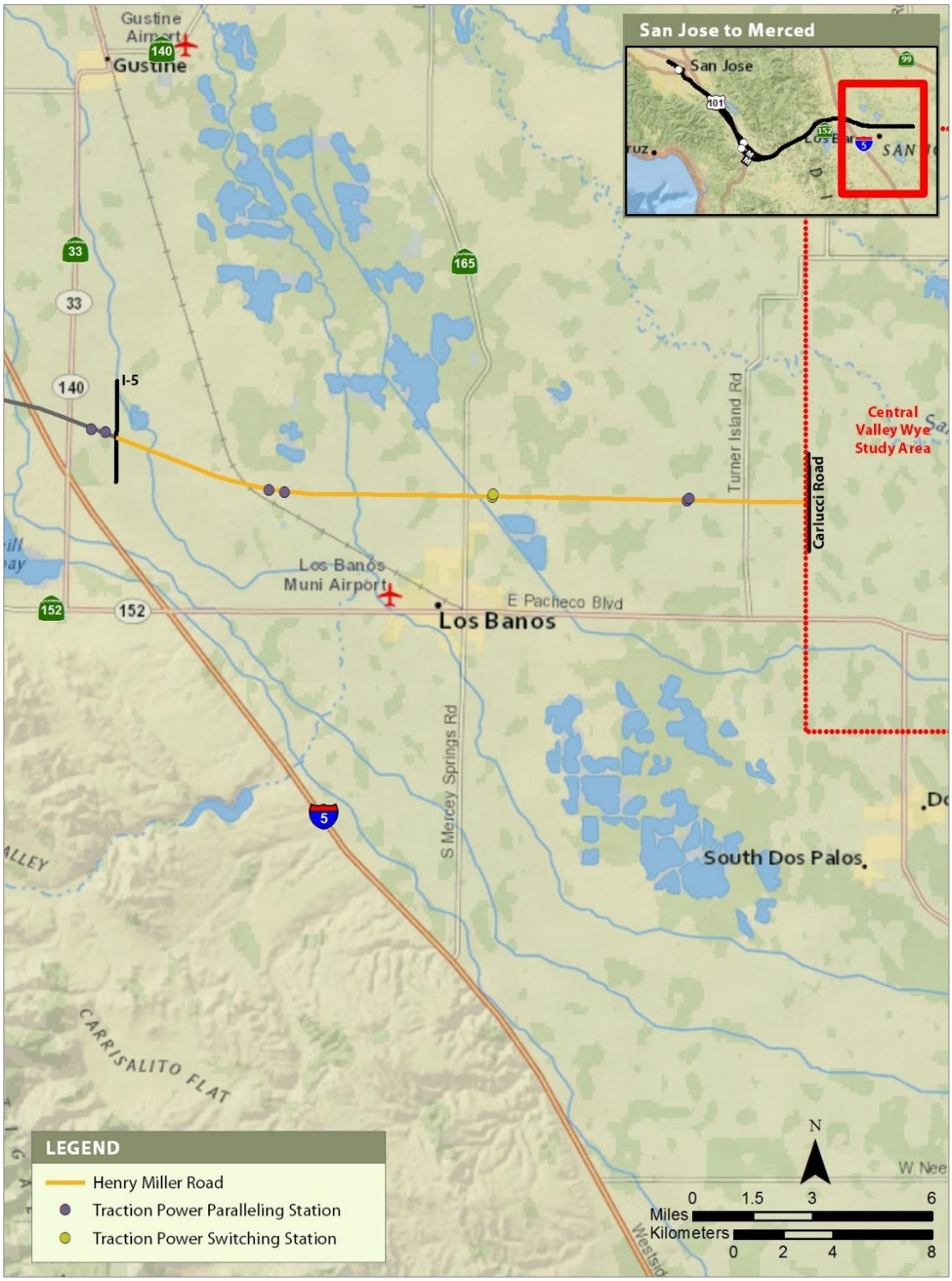


Source: Authority 2019 JULY 2019

Figure 3.6-13 Proposed HSR Electrical Components—Morgan Hill and Gilroy Subsection

Source: Authority 2019 JULY 2019

Figure 3.6-14 Proposed HSR Electrical Components—Pacheco Pass Subsection



Source: Authority 2019 JULY 2019

Figure 3.6-15 Proposed HSR Electrical Components—San Joaquin Valley Subsection

The three TPSSs for all alternatives, referred to as Site 3—San Jose, Site 4—Gilroy, and Site 5—O'Neill, would be built at locations where high-voltage power lines cross the alignment for each alternative. Each TPSS would include an approximately 450-square-foot (18 feet by 25 feet) control room and would require permanent use of a parcel of up to 2 acres. Switching stations (120 feet by 80 feet) would be co-located with TPSS where possible, and would be midway between the TPSSs, at approximately 15-mile intervals. Paralleling stations (18 feet by 25 feet) would be built at approximately 5-mile intervals between the switching stations and the TPSSs.

A permanent distribution line from the existing PG&E Quinto switching station (located north of the O'Neill Forebay near Santa Nella) to the McCabe Road tunnel portal location would provide power to the tunnel portal during construction and operation. PG&E electrical network upgrades required to support the project include the reconductoring of three existing 115-kV power lines for all alternatives. Construction activities associated with this reconductoring could result in temporary interruption of electrical service to utility customers and would require operation of helicopters to move electrical equipment. Impact PUE#1 discusses planned and accidental temporary interruption of electrical service, including temporary interruptions that may result from reconductoring of power lines.

Potable water and wastewater utility connections would be built for the San Jose Diridon Station, Downtown Gilroy/East Gilroy Stations, South Gilroy or East Gilroy MOWF, and MOWS near Turner Island Road for all alternatives to provide potable water for use by employees and to provide wastewater discharge to the local wastewater treatment system. Temporary construction impacts of the utility connection construction would include excavation and placement of the buried utility lines; there would be no permanent impacts from the buried utility connection construction. Establishment, design, and construction of potable water and wastewater discharge connections to the facilities would be subject to permits issued by local water and wastewater service providers in San Jose and Gilroy.

New stormwater management structures would be built for all alternatives. Stormwater drainage infrastructure would be constructed at the Guadalupe River crossing in San Jose for all alternatives. New storm drainage infrastructure would be built on the west side of the project at Atherton Way in Morgan Hill and at Carnadero Avenue in Gilroy in the Morgan Hill and Gilroy Subsection for Alternative 1 and Alternative 2. The contractor will construct new stormwater management structures in accordance with the SWPPP and stormwater management and treatment plan and in accordance with local water management authority permit requirements (HYD-IAMF#1), thereby minimizing environmental impacts. Permittees are required to produce an SWPPP prepared by a qualified developer or practitioner.

CEQA Conclusion

The impact would be less than significant under CEQA for all four alternatives for temporary impacts from construction of new utility infrastructure. Construction of the project would require the construction of new utility infrastructure, including new and expanded electric power, electrical utility connections, water and wastewater utility connections, and stormwater management structures, however, the construction of the new and expanded utility infrastructure would not cause significant environmental effects.

Construction of new stormwater management structures will result in less than significant impacts because compliance with the SWPPP, stormwater management and treatment plan, and local water management authority permit requirements (HYD-IAMF#1) will minimize environmental impacts. Project features will include effective measures to manage and treat stormwater through the installation of infiltration or detention facilities and incorporation of permeable vegetated surfaces to accommodate increased rates and amount of runoff, and to increase infiltration and groundwater recharge. In addition, the contractor would construct new water and wastewater connections in accordance with local water management authority standards and permit requirements to minimize impacts from the construction of new potable water and wastewater utility line connections to the stations and maintenance facilities. Construction of new utility infrastructure would result in less than significant impacts due to compliance with established

plans and permit requirements that would effectively address potential environmental effects. Therefore, CEQA does not require mitigation.

Impact PUE#6: Temporary Impacts from Stormwater and Wastewater Generation during Construction

During construction, temporary dewatering could be required in some locations in the RSA because of the shallow depth to groundwater (see Section 3.8). Dewatering operations may be needed when construction requires the removal of accumulated precipitation or groundwater from a construction work location. Dewatering operations may occur during demolition of pavement or structures; grading (including cut-and-fill slopes); excavation; paving; trenching and underground drainage; utility installation; bridge or structure construction; concrete work; or landscaping and irrigation. During dewatering, wastewater (i.e., extracted water) could be discharged through one of two methods: direct discharge into the local sanitary sewer system, or discharge to a surface waterbody. Temporary impacts to drainage patterns and stormwater runoff during construction are described in Section 3.8 in Impact HYD#1. Impact HYD#8: Temporary impacts on groundwater quality and volume during construction are described in Section 3.8 in Impact HYD#8.

Permit requirements for discharge of water from dewatering activities to surface water are described in Section 3.8. Under the Clean Water Act, entities discharging stormwater from construction sites must comply with the conditions of an NPDES permit. The SWRCB is the permit authority in California and has adopted the Construction General Permit (CGP); permittees are required to produce an SWPPP prepared by a qualified developer or practitioner. The NPDES also requires that states develop and implement municipal stormwater management programs to meet the requirements for stormwater discharges from municipal separate storm sewer systems (MS4). The Authority is designated as a nontraditional permittee under the Phase II MS4 permit. The MS4 permit requirements that apply to watersheds in the project footprint are shown in Table 3.8 1. Discharges to surface water would be permitted under the NPDES through the CGP and the MS4 permit programs.

Wastewater generated from tunnel boring machine operation could be discharged to a surface waterbody in accordance with an individual Waste Discharge Requirement/NPDES permit that would be issued by the RWQCB. The RWQCBs with jurisdiction over the project extent are RWQCB Region 2—Santa Clara County (north of Morgan Hill); RWQCB Region 3—Santa Clara County (south of Morgan Hill) and northern San Benito County; and RWQCB Region 5—Merced County (San Francisco RWQCB 2017). The Authority would obtain permits for wastewater discharge from wastewater discharge permit agencies in Santa Clara, San Benito, and Merced Counties prior to commencement of construction activities that would entail wastewater generation and discharge. Water quality discharge permit conditions for discharges of wastewater to surface water would be established in accordance with the water quality objectives and other provisions of the Regional Board Water Quality Control Plan for the RWQCB Region; the permitting authority would develop a permit specifically for the wastewater-generating construction activity based on information contained in the discharge permit application (e.g., the type of activity, nature of discharge, receiving water quality) (SWRCB 2013, 2016; San Francisco RWQCB 2017; Central Valley RWQCB 2018; Central Coast RWQCB 2019).

Direct discharge of wastewater into the local sanitary sewer system from construction activities would only occur if the receiving wastewater treatment facility approves such disposal, subject to coordination with the local wastewater treatment authority concerning system capacity and maintenance. Proposed discharges into municipal sanitary lines, including the City of San Jose's sanitary lines, during construction would be coordinated with the local wastewater treatment authorities to address capacity and maintenance.

Because the local wastewater treatment authority must approve any disposal of extracted water through the sewer system, it is assumed this would only be allowed if there is adequate wastewater treatment capacity. If wastewater is discharged to the sewer, the wastewater treatment service provider would establish allowable flow rates, volumes, and frequency subject to a discharge permit. Runoff of water applied in construction areas to control dust and water for operation of TBMs would also generate construction wastewater. Construction water from dust control would

generally be discharged to the stormwater management system in accordance with a non-stormwater discharge permit issued by the local board. Construction water from operation of TBMs would be recirculated for reuse after separating the excavated solids from TBM operation, thereby reducing water consumption.

The project would minimize potential temporary impacts on stormwater management system capacity by managing and controlling stormwater and resulting runoff and erosion and pollution from stormwater discharges to minimize effects on stormwater management facility capacity. Temporary ground-disturbing activities from construction that could result in temporary changes to drainage patterns and stormwater runoff will be effectively minimized through development and implementation by the contractor of a SWPPP (HYD-IAMF#3: Prepare and Implement a Construction Stormwater Pollution Prevention Plan), compliance with the RWQCBs' dewatering requirements and dewatering plans that will be approved by the regulatory agencies (HYD-IAMF#3; GEO-IAMF#1: Geologic Hazards), and regular monitoring and enforcement of construction site permit conditions related to dewatering and diversion sites (BIO-IAMF#1: Project Biologist; HYD-IAMF#3).

The contractor will prepare and implement a construction SWPPP prior to construction under the CGP, including design features to minimize or avoid impacts on stormwater management facility capacity from the generation of stormwater (HYD-IAMF#3). The contractor's implementation of the SWPPP would provide best management practices (BMP) that would minimize potential short-term increases in stormwater generation and sediment transport caused by construction, including BMPs for erosion control requirements, stormwater management requirements, and channel dewatering for affected stream crossings. These BMPs would provide permeable surfaces where feasible and systems to retain or detain and treat stormwater from construction areas on-site. The SWPPP under the CGP for construction of the project would include BMPs that would minimize discharges of sediment from the construction site and manage construction equipment and materials to prevent leaks, spills, and accidental discharges to stormwater management facilities. These project features will reduce the amount of construction-area wastewater discharged to stormwater management systems and will therefore reduce the impacts on the capacity of existing stormwater management system facilities managed by local stormwater management authorities. In addition, these project features will improve the quality of the stormwater discharge from construction areas by requiring the contractor to develop and implement the SWPPP under the CGP.

Table 3.6-11 summarizes construction water use by alternative and construction activity. The amount of water that would be consumed for operation of concrete batch plants, construction (including excavation), and TBM operation is assumed to be equal to the amount of wastewater that would be generated from those activities; the amount of additional wastewater that would be generated from dewatering activities would vary depending on site characteristics and therefore has not been separately estimated. Impacts related to construction dewatering activities are assessed in the Chapter 3.8 under Impact HYD#8: Specific excavation and foundation depths for viaducts, overcrossings, radio communication antennae, and other structures would not be determined until the design phase, and the exact locations of water-bearing formations and boundaries for the tunnel construction would not be determined until geotechnical investigations have been conducted for the project. Based on preliminary groundwater monitoring data performed for the project, groundwater is expected to be encountered during tunnel boring, and based on the relatively shallow depths of groundwater in the RSA, dewatering is likely to be required for excavation and foundation construction. The Authority will minimize impacts on groundwater quality during all excavations, including tunnels, in accordance with the CGP (HYD-IAMF#3) and the Caltrans *Field Guide to Construction Dewatering* (Caltrans 2014) (GEO-IAMF#10: Geology and Soils).

For assessment of the adequacy of the local wastewater treatment system capacity and stormwater management system capacity, it is assumed that 100 percent of the construction water used would be discharged as either wastewater to municipal wastewater treatment facilities or as stormwater to stormwater management facilities. Alternative 1 would use 4,339 acre-feet of water over the 5-year construction period, Alternative 2 would use 4,205 acre-feet, Alternative 3

would use 4,555 acre-feet, and Alternative 4 would use 4,426 acre-feet (Tung 2017; Authority 2018a). In construction locations remote from municipal wastewater treatment and stormwater management infrastructure, construction water could be discharged to surface waterbodies, subject to surface water discharge permit conditions.

Table 3.6-5 summarizes the design capacities of municipal WWTPs within the public utilities RSA. The wastewater treatment capacity of the San Jose-Santa Clara Regional Wastewater Facility is 167 mgd and the treatment capacity of the SCRWA WWTP is 8.5 mgd. The wastewater treatment capacity of the Los Banos WWTP is 6.1 mgd. The wastewater treatment capacity of the Santa Nella WWTP is 0.4 mgd. The total wastewater treatment capacity of these municipal wastewater treatment systems is 182 mgd and the total average dry weather flow rate is 114.7 mgd.

Assuming that 100 percent of the water used is discharged either to wastewater treatment systems or stormwater management systems, the wastewater generation associated with construction of the project alternatives would be 0.38 mgd for Alternative 1, 0.36 mgd for Alternative 2; 0.42 mgd for Alternative 3, and 0.40 mgd for Alternative 4. Therefore, construction-related wastewater generation would less than 0.5 percent of the total wastewater treatment capacity within the public utilities RSA. Based on these estimates, current municipal wastewater treatment facilities have the capacity to accept and treat wastewater generated from construction of any of the project alternatives.

Each local stormwater management jurisdiction under the local jurisdiction's CGP program would permit stormwater discharges from project construction sites. Implementation of SWPPPs for construction sites and conformance of the project construction with local jurisdiction MS4 permit requirements and RWQCB requirements would minimize generation of stormwater from project construction. The Authority would use California Stormwater Quality Association BMP handbooks or equivalent to comply with the conditions of applicable Phase II MS4 permits within its right-of-way. In accordance with the SWPPP and applicable permit requirements, temporary stormwater management structures would be built as needed so the capacity of existing stormwater management systems would not be exceeded. Stormwater management facilities have the capacity to accept wastewater generated under any of the project alternatives.

CEQA Conclusion

There would be a less than significant impact under CEQA from temporary wastewater generation during construction, including wastewater generated from concrete work, earthwork, or TBM operation for any of the alternatives. The amount of temporary wastewater generation from construction activities would not exceed available wastewater treatment capacity or require expansion or new construction of wastewater treatment facilities. While construction will cause temporary increases in wastewater generation, project features, such as water reuse, will minimize the amount of additional water use and wastewater generation, and the contractor will apply BMPs including requirements for providing permeable surfaces and detaining and treating water from construction areas on-site. In addition, wastewater generated and discharged to WWTPs during construction would be discharged and treated in a manner approved by permits issued by the local wastewater management authority, and wastewater discharged to surface waterbodies would be subject to wastewater discharge permit conditions. The amount of water discharged for treatment at existing WWTPs operated by local authorities would not require the expansion of utilities because wastewater would not exceed the capacity of local authority wastewater treatment or stormwater management facilities. The current capacities and demands allow for the estimated amount of wastewater under all of the alternatives to be accommodated.

There would be a less than significant impact under CEQA from temporary stormwater generation during construction. Temporary impacts on drainage patterns and stormwater runoff during construction are described in Chapter 3.8 under Impact HYD#1. Project features, including implementation of the SWPPP and conformance with the CGP and local stormwater management jurisdiction permit requirements, will minimize stormwater generation from construction activities. In accordance with the SWPPP and applicable permit requirements, temporary stormwater management structures would be built as needed such that the capacity of existing stormwater management systems would not be exceeded. These project features will

minimize temporary impacts from wastewater generation on water use and demands and capacities of local WWTPs and stormwater management facilities and result in a less than significant impact. Therefore, CEQA does not require mitigation.

Impact PUE#7: Temporary Generation of Solid and Hazardous Waste during Construction

Construction of the project alternatives would generate solid waste from clearing of vegetation, grading, demolition of existing structures, and cut-and-fill construction activities. Construction would also generate hazardous waste consisting of welding materials, fuel and lubricant containers, paint and solvent containers, treated wood, and cement products containing strong basic or acidic chemicals. Demolition of older buildings could also generate hazardous waste, such as asbestos-containing materials and lead-based paint.

Construction of Alternative 1 would require approximately 813 acres of grading and would generate approximately 7.1 million cubic yards of excess cut material, assuming that cut material generated from construction is reused as fill material elsewhere for construction. Alternative 1 would therefore require disposal or reuse of 7.1 million cubic yards of cut material in excess of the amount that would be required for construction fill. Construction of Alternative 2 would require 1,047 acres of grading and would generate approximately 6.7 million cubic yards of excess cut material. Construction of Alternative 3 would require approximately 870 acres of grading and would generate approximately 5.3 million cubic yards of excess cut material, and Alternative 4 would require 1,048 acres of grading and would generate approximately 6.5 million cubic yards of excess cut material (Authority 2018a). Project construction would be conducted in accordance with the Authority's Sustainability Policy including policies pertaining to waste diversion and recycling. Solid waste (C&D debris) generated from demolition activities and excess fill material generated from grading may not be reusable or recyclable and may therefore need to be disposed of in solid waste landfills.

Table 3.6-14 presents solid and hazardous waste landfill capacity by facility and estimated solid waste generation by project alternative including application of the project demolition plan that will be developed under HMW-IAMF#5: Demolition Plans, and that will minimize generation of C&D debris from construction activities and demolition of building floor space. Alternative 1 would involve demolition of 4.3 million square feet of building floor space. Alternative 2 would involve demolition of 7.1 million square feet of floor space. Alternative 3 would involve demolition of 4.0 million square feet of floor space. Alternative 4 would involve demolition of 2.0 million square feet of floor space. For construction of the alternatives, approximately 199,300 cubic yards of C&D debris would be generated under Alternative 1, 325,000 cubic yards under Alternative 2, 184,800 cubic yards under Alternative 3, and 90,100 cubic yards under Alternative 4 (Authority 2018a). Data for hazardous waste generation from construction activities are not available; however, the amount of hazardous waste generation from construction is assumed to be no greater than the amount of nonhazardous waste generation from construction for the purposes of comparison to available hazardous waste disposal capacity. Tunnel excavation for all project alternatives would generate approximately 4.8 million cubic yards of soil and rock materials (an estimated 0.5 million cubic yards from Tunnel 1, at the eastern end of the Morgan Hill and Gilroy Subsection and 4.3 million cubic yards from Tunnel 2, through Pacheco Pass).

Solid waste landfills identified in Table 3.6-14 in the RSA in the vicinity of Santa Clara, San Benito, and Merced Counties could be used for nonhazardous solid waste disposal. Collectively these nonhazardous solid waste landfills have an estimated 92.5 million cubic yards of remaining disposal capacity. Therefore, existing nonhazardous solid waste landfills would have adequate estimated capacities through 2038 or longer for the disposal of C&D material, which would comprise up to 0.6 percent of the remaining capacity.

There are three RCRA-permitted hazardous waste landfills in California—the Kettleman Hills Facility in Kings County; the Clean Harbors Facility in Buttonwillow in Kern County; and the Clean Harbors Facility in Westmorland in Imperial County (California Department of Toxic Substances Control (DTSC) n.d., 2014; Clean Harbors 2017a, 2017b). The Kettleman Hills facility is approximately 140 miles south of Gilroy and the Clean Harbors Buttonwood Facility is approximately 200 miles south of Gilroy. The Clean Harbors Westmorland Facility is approximately

500 miles south of Gilroy and services Southern California and Mexico (Clean Harbors 2017b). These sites and their capacities relative to the project alternatives are listed in Table 3.6-15.

Table 3.6-14 Solid Waste Generation Estimates by Alternative in Cubic Yards

Estimated Solid and Hazardous Waste Generation by Alternative[1]			
Alternative 1	Alternative 2	Alternative 3	Alternative 4
199,300	325,000	184,800	90,100

Solid Waste Landfill Facility and Capacity					
Remaining Landfill Capacity (cubic yards)		Sufficient Remaining Capacity?			
		Alternative 1	Alternative 2	Alternative 3	Alternative 4
Kirby Canyon Recycling and Disposal Facility	16,191,000	Yes	Yes	Yes	Yes
Guadalupe Community Facility	11,055,000	Yes	Yes	Yes	Yes
Newby Island Sanitary Landfill	21,200,000	Yes	Yes	Yes	Yes
John Smith Road Class III Landfill	4,625,830	Yes	Yes	Yes	Yes
Billy Wright Landfill Unit 01	11,370,000	Yes	Yes	Yes	Yes
Highway 59 Landfill	28,025,330	Yes	Yes	Yes	Yes

Source: CalRecycle 2019a; 2019b, 2019c, 2019d, 2019e, 2019f, Authority 2018a
Waste required under each alternative is not broken down by facility, but is rather provided as a total. The amount of waste would be distributed to available facilities as needed based on the location and the available capacities of those facilities.
[1] Solid waste generation values are for C&D debris that would be generated from building and other demolition activities and that would be disposed of in licensed C&D debris landfills. Solid waste generation values do not include tunnel boring machine spoils or cut-and-fill material that would generally be reused for construction and not disposed of in landfills.
C&D = construction and demolition

Table 3.6-15 Hazardous Waste Generation Estimates by Alternative in Cubic Yards

Estimated Hazardous Waste Generation by Alternative[1]			
Alternative 1	Alternative 2	Alternative 3	Alternative 4
199,300	325,000	184,800	90,100

Hazardous Waste Landfill Facility and Capacity					
Remaining Landfill Capacity (cubic yards)		Sufficient Remaining Capacity?			
		Alternative 1	Alternative 2	Alternative 3	Alternative 4
Clean Harbors Westmorland Landfill, Westmorland CA	5 million	Yes	Yes	Yes	Yes
Clean Harbors Landfill, Buttonwillow CA (hazardous waste capacity)	5 million (estimated)	Yes	Yes	Yes	Yes
Kettleman Hills Landfill, Kettleman City CA (hazardous waste capacity)	4.9 million	Yes	Yes	Yes	Yes

Sources: Clean Harbors 2017a, 2017b
[1] The amount of hazardous waste generation from construction is assumed to be no greater than the amount of nonhazardous waste generation from construction for the purposes of comparison to available hazardous waste disposal capacity.

The Kettleman Hills hazardous waste disposal facility in Kings County has a remaining disposal capacity of approximately 4.9 million cubic yards based on DTSC) approval of a permitted expansion in 2014 (DTSC 2014). The Kettleman Hills facility is planning the development of a new hazardous waste landfill (Unit B-20) on currently undeveloped land at the Kettleman Hills site, to open after current unit B-18 reaches capacity, and the facility is planning to operate for approximately 24 years (Waste Management 2017b). The Clean Harbors Buttonwillow Facility has a permitted hazardous waste disposal capacity of 13.25 million cubic yards and an estimated closure date of 2040 (CalRecycle 2014b). Clean Harbors reported a permitted disposal capacity in excess of 10 million cubic yards for the Buttonwillow landfill (Clean Harbors 2017a). The California DTSC database does not include an estimate of the remaining disposal capacity of the Clean Harbors Buttonwillow landfill. Based on the reported closure date of 2040 it is estimated that 50 percent of the permitted capacity remains available. Based on the estimated 14.9 million cubic yards of available hazardous waste landfill capacity for the three hazardous waste landfills in Kern County, Imperial County, and Kings County, hazardous waste landfill capacity within California is adequate for the anticipated hazardous waste generation for the construction of each alternative, which would comprise up to 3.5 percent of remaining capacity.

The Authority will develop and implement a demolition plan, which will include procedures to identify and minimize generation of hazardous waste from C&D activities (HMW-IAMF#5). Prior to demolition activities, the contractor would evaluate whether the structures proposed for demolition contain asbestos or lead, in accordance with federal regulatory requirements as discussed in Impact HMW#4 and Impact HMW#5 in Section 3.10 Hazardous Materials and Waste. Determining the existence of lead and removing it safely is important to preserving the long-term health of individuals working near or with potentially contaminated structures or sites. General personal protection practices would also be implemented as part of HMW-IAMF#5 and in accordance with California Division of Occupational Safety and Health regulatory requirements. The plan would include plans and procedures for safe dismantling and removal of building components and debris, including a plan for the abatement of lead and asbestos, which may be prevalent in older structures. Implementation of the demolition plan would promote segregation of asbestos and lead-containing waste from nonhazardous solid waste and would therefore reduce the amount of hazardous waste generated from demolition activities and the need for hazardous waste disposal capacity.

CEQA Conclusion

There would be a less than significant impact under CEQA from temporary solid waste generation during construction and a less than significant impact from temporary hazardous waste generation during construction. Construction of the project would not generate solid waste in excess of state or local standards or in excess of the capacity of local infrastructure and would not impair the attainment of state or local solid waste reduction goals.

Solid waste management facilities within the RSA and hazardous waste management facilities within California would have sufficient permitted capacity to accept solid waste and hazardous waste generated from construction of the project, and the CEQA impact from temporary solid and hazardous waste generation would be less than significant. There would be a less than significant impact under CEQA from solid and hazardous waste generation and disposal during construction for any of the alternatives because solid waste produced would not exceed the permitted disposal capacity of existing solid waste disposal facilities in the RSA and hazardous waste generation would not exceed the permitted disposal capacity of existing hazardous waste disposal facilities in California. Therefore, the project would not require construction and permitting of any new solid waste disposal or hazardous waste disposal infrastructure, and the CEQA impact would be less than significant. Impacts from hazardous wastes would be avoided through safe handling and disposal procedures. Solid waste, including solid waste produced during grading and cut-and-fill activities, would be reused where applicable, while any additional solid wastes would be sent to proper disposal facilities (landfills). Solid waste and hazardous waste disposal procedures would comply with federal, state, and local statutes and regulations related to solid waste and hazardous waste management and the CEQA impact would therefore be less than significant. Therefore, CEQA does not require mitigation.

The Authority would require construction contractors to prepare demolition plans with specific provisions for the safe dismantling and removal of building components and debris and segregation and management of solid and hazardous waste generated in accordance with regulatory requirements. The demolition plans would include requirements for identification and abatement of lead and asbestos hazards for commercial and industrial buildings and roadways slated for demolition or renovation. As part of the project design the contractor would comply with regulations that control the transport, use, storage, and disposal of hazardous materials and hazardous wastes generated during construction. The contractor will implement a written hazardous materials and waste management plan that will describe responsible parties and procedures for hazardous waste transport, containment, storage and disposal and hazardous material and hazardous waste management BMPs (HMF-IAMF#7, HMW-IAMF#8, HMW-IAMF#10). The contractor would implement procedures to safely handle and dispose of hazardous waste and separate hazardous wastes from nonhazardous wastes to reduce the amount of hazardous waste generated, including procedures to identify potential asbestos-containing structures and lead-containing structures prior to demolition, abatement of lead and asbestos hazards, and segregation of hazardous and nonhazardous wastes. Through implementation of IAMFs, construction of the alternatives would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials and there would be a less than significant impact. Therefore, CEQA does not require mitigation.

Operations Impacts

Operation of the project alternatives would include operation of HSR trains, stations, and maintenance facilities and maintenance of the trains, track, and right-of-way. Operation of the project would result in consumption of water for operation of stations and maintenance facilities and generation of wastewater, solid wastes, and hazardous wastes from operation of stations and maintenance facilities. Runoff of precipitation on impervious services in the right-of-way and at stations and maintenance facilities would generate stormwater. Chapter 2 describes operations activities in more detail.

Impact PUE#8: Continuous Permanent Impacts from Water Use

HSR stations and maintenance facilities, including the South Gilroy or East Gilroy MOWF and MOWS near Turner Island Road, would require operational water supply for a variety of uses, including drinking fountains and restrooms, landscaping irrigation, and station and facility maintenance wash water. Operations at the San Jose Diridon Station and the Downtown Gilroy or East Gilroy Stations would also require water.

The expanded San Jose Diridon Station and Gilroy Station would require additional water for restroom facilities, drinking water fountains, landscaping irrigation and other outdoor uses, and cleaning and station maintenance activities in addition to the existing water demand for the stations. The estimated average potable water demand for the San Jose Diridon Station after expansion would be 24,200 gpd, two-thirds of which would be potable water use within the station (16,025 gpd) and one-third of which would be used for landscaping and other outdoor uses (8,150 gpd). The existing San Jose Diridon Station used 5,400 gpd of water in 2016 for indoor and outdoor uses. The Downtown Gilroy Station would use an estimated 15,800 gpd based on the estimated station and grounds square footage. The East Gilroy Station would use an estimated 15,350 gpd based on the estimated station and grounds square footage. Approximately 10,500 gpd potable water would be used within the Downtown Gilroy Station and the remaining 5,330 gpd would be used outdoors. For the East Gilroy Station, approximately 10,200 gpd potable water would be used within the station and the remaining 5,200 gpd would be used outdoors. The existing Gilroy Station is only a platform, with no restrooms or landscaping water use; water at the existing Gilroy Station is required only for cleaning and maintenance activities. Water consumption for the existing Gilroy Station was 356 gpd in 2016. The total water consumption for both the San Jose Diridon Station and the Downtown Gilroy Station would be 40,000 gpd, and for the San Jose Diridon Station and East Gilroy Station would be 39,500 gpd, two-thirds of which is anticipated to be potable water consumption.

Maintenance activities that would require a water supply at the South Gilroy or East Gilroy MOWF would include cleaning and servicing activities between HSR train trips, maintenance activities, and operation of train wash and wheel defect detection facilities. The MOWF would provide for dispatch, maintenance, and repair of rail-mounted equipment and include support quarters for maintenance personnel. Water would be used for train wash and maintenance activities and to provide potable water for the maintenance personnel quarters. The MOWS would support maintenance activities by providing a location for layover of maintenance of infrastructure equipment and temporary storage of materials and other resources. Water consumption for operation of the MOWF would be required for personnel, including operation of drinking fountains, restrooms, kitchen/canteens, showers, and other potable uses.

Potable water consumption would be approximately 84,000 gpd at the MOWF and 98,000 gpd at the MOWS, for a total of 182,000 mgd of potable water for both maintenance facilities. Water consumption would also be required for use by road and rail-mounted equipment including rail-grinding train runs and other maintenance activities. Water used for maintenance activities at the MOWF and the MOWS would not need to be of drinking water quality, and nonpotable water consumption is estimated as 1,000 gpd for the MOWF and 1,000 gpd for the MOWS (Tung 2017). Annual total water consumption for the MOWF and the MOWS including potable water and nonpotable water would be 184,000 gpd, of which 182,000 gpd would be for potable uses and 2,000 gpd would be for industrial (nonpotable) uses.

The total water demand for water usage at the two stations would be approximately 40,000 gpd and total water usage at the two maintenance facilities would be 184,000 gpd, for a total of 224,000 gpd (250 acre-feet per year) water demand. Because the average California household uses 446–893 gpd, this is equivalent to the amount of water consumed annually by approximately 250–500 California households. The demand for potable water in urban areas of the public utilities RSA was approximately 165,724 acre-feet per year in 2015, with the highest demand in San Jose (139,907 acre-feet per year). Water consumption for operation of the San Jose Diridon Station, Gilroy Station, MOWF, and MOWS would constitute 0.15 percent of the total water demand for urban areas in the RSA.

The project stations and maintenance facilities could use recycled water provided by the regional water service providers that provide recycled water for nonpotable uses, such as the SBWR in Santa Clara and San Jose and the SCRWA in Gilroy. The Authority would assess the availability of recycled water and use it for nonpotable uses at stations and maintenance facilities when feasible, minimizing water consumption (Authority 2015). Prior to construction, the Authority would determine the availability of recycled water supply to the San Jose Diridon and Downtown Gilroy/East Gilroy Stations and the South Gilroy or East Gilroy MOWF and MOWS near Turner Island Road from each regional water service provider, and would incorporate the use of recycled water for nonpotable water uses at project stations and facilities if the regional service providers have the capability and capacity to provide recycled water.

Use of potable water for operation of the stations, MOWF, and MOWS would be minimized through compliance with the Authority's Water Conservation Guidance (Authority 2015). This guidance includes specific requirements that would minimize the use of potable water, including requiring the use of efficient facilities; using nonpotable water for irrigation, wherever possible; and requiring reusing water from water flushing. Therefore, the demand for potable water during operation could be less than that estimated in this analysis.

CEQA Conclusion

There would be a less than significant impact under CEQA from continuous permanent water use during project operation because sufficient water supplies would be available to serve the project, including water consumption for stations and maintenance facilities and reasonably foreseeable future development during normal, dry, and multiple dry years. Through compliance with the Authority's Water Conservation Guidance requirements (Authority 2015), the Authority would minimize water use during operation. The project would result in a permanent increase in water use; however, this increase would be small relative to existing water supply. Water consumption for operation of the San Jose Diridon Station, Gilroy Station, MOWF, and MOWS would constitute

0.15 percent of the total water demand for urban areas in the RSA (equivalent to the amount of water consumed by 250 – 500 California households). Project features will include systems and procedures to reuse water and reduce consumption that will minimize the need for water during operations. Stations and maintenance facilities would use recycled or reclaimed water for nonpotable uses where recycled water is available and where such use is permitted to reduce overall water use and reduce the amount of potable water needed for operation.

Construction of the project would result in a net decrease in water consumption compared to existing land uses (e.g., agricultural uses) of the project footprint, as shown in Appendix 3.6.C, Water Use Assessment. Therefore, sufficient water supplies would be available to serve operation of the project and reasonably foreseeable future development during normal, dry, and multiple dry years. Accordingly, the impact on water supplies from operational water use would be less than significant under CEQA. Therefore, CEQA does not require mitigation.

Impact PUE#9: Continuous Permanent Impacts from Wastewater Generation

A variety of uses, including drinking fountains and restrooms, landscaping irrigation, and station and facility maintenance wash water, would generate wastewater at San Jose Diridon Station, Downtown Gilroy/East Gilroy Station, and maintenance facilities including the South Gilroy or East Gilroy MOWF. Potable water consumption and nonpotable water consumption would generate wastewater at the MOWF. The amount of wastewater generated from each maintenance facility is assumed to be 100 percent of the potable and nonpotable water consumption. As described under Impact PUE#8, annual water consumption for the MOWF and the MOWS would be a total of 184,200 gpd, of which 182,200 gpd would be for potable uses and 2,000 gpd would be for industrial (nonpotable) uses.

Wastewater from the South Gilroy or East Gilroy MOWF would be discharged to the sewer, which is operated and maintained by SCRWA. Wastewater generated from operation of the South Gilroy or East Gilroy MOWF would represent 1.0 percent of the 8.5 mgd wastewater treatment capacity provided by the SCRWA. Wastewater generated from the MOWS near Turner Island Road would be discharged to the sewer, which is operated and maintained by the Merced County Water District (County of Merced 2017). Wastewater generation from operation of the MOWS would represent 1.6 percent of the 6.0 mgd wastewater treatment capacity provided by the City of Los Banos.

The San Jose Diridon Station would include restroom facilities that would generate wastewater discharges to the local sewer system. The average wastewater flows for the San Jose Diridon Station would be 24,200 gpd assuming that the amount of water used at the station would be equal to amount of wastewater discharged from the station. The wastewater generated from the San Jose Diridon Station would represent 0.01 percent of the 167 mgd wastewater treatment capacity provided by the San Jose-Santa Clara Regional Wastewater Facility.

Wastewater generation for the Downtown Gilroy or East Gilroy Station would be associated with maintenance and cleaning activities. This wastewater generation—15,800 gpd for the Downtown Gilroy Station and 15,350 gpd for the East Gilroy Station—would represent 0.18 percent of the 8.5 mgd wastewater treatment capacity provided by the SCRWA. Wastewater generation from operation of the MOWF would represent 1.1 percent of the 8.5 mgd wastewater treatment capacity provided by the SCRWA.

Direct discharge of wastewater into the local sanitary sewer system from station and maintenance facility operations would only occur if the receiving wastewater treatment facility approves such disposal, subject to coordination with the local wastewater treatment authority concerning system capacity and maintenance. Proposed discharges into municipal sanitary lines, including the City of San Jose's sanitary lines, during operation would be coordinated with the local wastewater treatment authorities to address capacity and maintenance.

The amount of wastewater generated by the San Jose Diridon and Downtown Gilroy or East Gilroy Stations, South Gilroy or East Gilroy MOWF, and MOWS near Turner Island Road would be approximately the same for all project alternatives because these features are common to all alternatives. Water consumption and wastewater generation for the East Gilroy Station would be

approximately 500 gpd lower than water consumption and wastewater generation for the Downtown Gilroy Station.

CEQA Conclusion

There would be a less than significant impact under CEQA from continuous permanent wastewater generation during project operation. Wastewater generated at stations and maintenance facilities during operations would be discharged to the sewer system and would represent less than 1 percent of the available treatment capacities of local wastewater treatment facilities. Thus, there is adequate wastewater treatment capacity at existing WWTPs to serve the project's projected wastewater treatment demand, in addition to the existing WWTPs' existing commitments. The construction of new wastewater infrastructure or the expansion of existing facilities would not be required. Furthermore, the WWTPs that would serve the project are required to adhere to RWQCB treatment requirements. The wastewater generated by the project would, therefore, not exceed RWQCB wastewater treatment requirements. Thus, the impact from wastewater generated during operation of the project would less than significant under CEQA. Therefore, CEQA does not require mitigation.

There would be a less than significant impact under CEQA from continuous permanent wastewater generation from operations and maintenance activities for any of the alternatives. Wastewater generated at stations and maintenance facilities during operations would be discharged to the sewer system and would represent approximately 0.1 percent of the available wastewater treatment capacity in the RSA. Therefore, the wastewater generated from operation of the stations and maintenance facilities would not exceed the available treatment capacity of local WWTPs. Wastewater generated at stations and maintenance facilities during operations would represent less than 1 percent of the available treatment capacities of local wastewater treatment facilities. There is adequate capacity at the existing WWTPs and therefore project operation would not result in the need to expand existing or construct new wastewater treatment capacity. The WWTPs that would serve the project are required to adhere to RWQCB treatment requirements, and the wastewater generated by the project would not result in any exceedance of RWQCB wastewater treatment requirements. Thus, the impact from wastewater generated during operation of the project would be less than significant under CEQA. Therefore, CEQA does not require mitigation.

Impact PUE#10: Continuous Permanent Impacts on Storm Drainage Facilities

Construction of the project would cause permanent changes in drainage patterns from the excavation and placement of fill, widening of existing embankments, and new impervious surfaces. These changes would affect stormwater runoff during rain events, including changes in runoff volume and rates and increased pollutant loading, compared to existing conditions. The design of the project will include on-site stormwater management facilities, which will capture runoff and provide treatment prior to discharge (HYD-IAMF#1, Storm Water Management). The on-site storm drainage system would consist of open ditches or subsurface drains placed at the outer sides of the railbed. An open ditch is a natural or built structure that conveys water with the top surface in contact with the atmosphere. Subsurface drainage systems are necessary to rapidly remove and prevent water from interfering with track stability, roadbeds, and side slopes, or where right-of-way constrains the use of open ditches. The runoff generated on-site would be discharged into the drainage system of the adjacent at-grade guideway. Water from the open ditches and under drains would either enter the local storm drain system or directly enter into the off-site drainage systems. Conceptual drainage was evaluated, and adequate right-of-way is available for drainage and detention. Permanent impacts to drainage patterns and stormwater runoff are discussed Section 3.8 in Impact HYD#2.

Construction of new infrastructure will be designed to prevent saturation, increase infiltration, and stabilize soils where streamflow velocities are increased to minimize potential impacts related to erosion and surface water hydrology (HYD-IAMF#2: Flood Protection). Stormwater management practices and measures as well as permeable surfaces to retain or detain and treat stormwater on-site will also be incorporated into the design of the project (HYD-IAMF#3: Prepare and Implement a Construction Stormwater Pollution Prevention Plan). In addition, stormwater runoff

will be effectively managed and treated through the installation of infiltration or detention facilities and incorporation of permeable vegetated surfaces to accommodate increased rates and amount of runoff, and to increase infiltration and groundwater recharge (HYD-IAMF#4: Prepare and Implement an Industrial Stormwater Pollution Prevention Plan). The Authority would also implement additional flow control measures where local regulations or drainage requirements dictate. Section 3.8 provides further detailed analysis regarding potential impacts on drainage and stormwater runoff.

CEQA Conclusion

The impact to stormwater drainage facilities would be less than significant under CEQA because the project would not require or result in the relocation or construction of new or expanded stormwater drainage facilities beyond those built within the project footprint as part of the project analyzed throughout this EIR/EIS, the construction of which could cause significant environmental effects. Permanent impacts on drainage patterns and stormwater runoff are described in Chapter 3.8 under Impact HYD#2. Project features will include effective measures to manage and treat stormwater through the installation of infiltration or detention facilities and incorporation of permeable vegetated surfaces to accommodate increased rates and amount of runoff, and to increase infiltration and groundwater recharge. Thus, operation of the project would not result in the construction of new or expanded stormwater drainage facilities beyond those constructed within the project footprint as part of the project analyzed throughout this EIR/EIS. This impact would be less than significant. Therefore, CEQA does not require mitigation.

Impact PUE#11: Continuous Permanent Generation of Solid Waste and Hazardous Waste

Operation of the San Jose Diridon Station would generate approximately 570 cubic yards per year of nonhazardous solid waste under all of the project alternatives. Nonhazardous solid waste would include domestic trash generated by rail passengers and station employees and waste from station cleaning and maintenance activities. This would be an increase of approximately 450 percent from the existing San Jose Diridon Station, which currently generates approximately 130 cubic yards per year of nonhazardous solid waste (Authority 2018b). The Downtown Gilroy Station would generate approximately 370 cubic yards of nonhazardous waste, and the East Gilroy Station would generate approximately 360 cubic yards per year of nonhazardous solid waste, under each of the alternatives, compared to the approximately 15 cubic yards of nonhazardous solid waste generated per year from existing operations at the existing Gilroy Station without implementation of the project (Authority 2018b). The amounts of solid waste from operation of the two stations would not affect the available capacity of municipal solid waste landfills servicing Santa Clara County. As shown in Table 3.6-6, the remaining capacity of municipal solid waste landfills in Santa Clara County is approximately 50 million cubic yards, and permitted disposal capacity is approximately 7,900 tons per day. The annual generation of 570 cubic yards of solid waste from the San Jose Diridon Station represents approximately 0.0012 percent of remaining disposal capacity in Santa Clara County. The annual generation of 370 cubic yards of solid waste from the Downtown Gilroy Station or 360 cubic yards of solid waste from the East Gilroy Station represents approximately 0.0005 percent of remaining permitted solid waste disposal capacity in Santa Clara County. The solid waste landfills within the RSA are licensed for decades of operation (one facility in Merced County is licensed to operate until 2054) and the facilities collectively have 100 million cubic yards of disposal capacity (see Table 3.6-6 in Section 3.6.5.1). County and municipal government planning processes would anticipate the need for replacement of solid waste disposal capacity as the licensed operation periods of these facilities approach their conclusion, therefore no shortage of disposal capacity is expected over the operating life of the HSR facilities.

Operation of the South Gilroy or East Gilroy MOWF and the MOWS near Turner Island Road would also generate nonhazardous solid waste from employee and operational activities, such as domestic trash from employees and nonhazardous industrial solid waste from maintenance of trains and operation of maintenance equipment. The South Gilroy or East Gilroy MOWF and the MOWS near Turner Island Road would generate approximately 755 cubic yards and approximately 885 cubic yards of nonhazardous solid waste, respectively. These amounts of solid waste would not exceed the available disposal capacity of municipal solid waste landfills servicing

Santa Clara, San Benito, and Merced Counties. The remaining capacity of municipal solid waste landfills in San Benito and Merced Counties is approximately 16 million cubic yards and the permitted disposal capacity is 2,000 tons per day. The remaining capacity of municipal solid waste landfills in Santa Clara County is approximately 50 million cubic yards, and permitted disposal capacity is approximately 10,000 tons per day. The annual generation of 755 cubic yards of solid waste from the South Gilroy or East Gilroy MOWF represents approximately 0.04 percent of remaining disposal capacity in Santa Clara County, and the annual generation of 833 cubic yards of solid waste from the MOWS near Turner Island Road represents approximately 0.05 percent of remaining permitted solid waste disposal capacity in San Benito and Merced Counties. The Authority would be required to adhere to state law (AB 75), which requires state agencies to divert at least 50 percent of solid waste from landfill disposal. The amount of solid waste disposed of in landfills in Santa Clara, San Benito, and Merced Counties would be reduced through the Authority's adherence to the solid waste diversion requirements.

Operation of the San Jose Diridon Station, Downtown Gilroy or East Gilroy Station, South Gilroy or East Gilroy MOWF, and MOWS near Turner Island Road would also involve the use, storage, and disposal of hazardous materials, including petroleum products, associated with maintenance of HSR equipment. Hazardous waste may consist of welding materials, fuel and lubricant containers, batteries, and paint and solvent residues and containers. All hazardous wastes will be handled, stored, transported, and disposed of in accordance with RCRA requirements (HMW-IAMF#7, HMW-IAMF#10). A certified hazardous waste collection company would transport the waste to an authorized hazardous waste management facility for recycling or disposal.

Hazardous waste landfills in California have adequate capacity to dispose of hazardous waste generated from operation of the San Jose Diridon Station, Downtown Gilroy or East Gilroy Station, South Gilroy or East Gilroy MOWF, and the MOWS near Turner Island Road. The Authority anticipates that the amount of hazardous waste generated from operation of the stations, MOWF, and the MOWS near Turner Island Road would be less than the amount of nonhazardous solid waste generated from these facilities. The total amount of hazardous waste generated from the stations, MOWF, and MOWS near Turner Island Road is assumed to not exceed 4,767 cubic yards per year based on the amount of nonhazardous solid waste generated.

The Kettleman Hills hazardous waste disposal facility in Kings County, California has a remaining disposal capacity of approximately 4.9 million cubic yards based on DTSC approval of a permitted expansion in 2014 (DTSC 2014; Kettleman Hills Landfill 2017). The Clean Harbors Buttonwillow Facility has a permitted hazardous waste disposal capacity of 13.25 million cubic yards and an estimated closure date of 2040 (CalRecycle 2014b). The estimated generation of 4,767 cubic yards of hazardous waste from the maintenance facilities represents approximately 0.05 percent of the estimated 9.9 million cubic yards of available hazardous waste landfill capacity for the two landfills. Therefore, hazardous waste landfill capacity is adequate for the anticipated hazardous waste generation for the operation of each project alternative.

CEQA Conclusion

There would be a less than significant impact under CEQA from continuous permanent solid waste generation during operation and a less than significant impact from continuous permanent hazardous waste generation during operation. Operation of the project would not generate solid waste in excess of state or local standards or in excess of the capacity of local infrastructure, and would not impair the attainment of state or local solid waste reduction goals. There would be a less than significant impact under CEQA from nonhazardous solid and hazardous waste generation during operation and maintenance activities for any of the alternatives because solid nonhazardous and hazardous waste generated during these operations and maintenance activities would not exceed the capacity of permitted solid waste landfills in the RSA and would not exceed the permitted capacity of hazardous waste landfills in California. No new solid waste disposal infrastructure and no new hazardous waste disposal infrastructure would need to be constructed and permitted as result of the project, and solid waste generation from project operation would not impair the attainment of solid waste reduction goals. Solid waste will be disposed of in accordance with solid waste landfill permit requirements and hazardous waste will be disposed of in a manner consistent with RCRA regulations (HMW-IAMF#7, HMW-IAMF#10).

As part of project operations, the Authority would comply with regulations that control the transport, use, storage, and disposal of hazardous materials and hazardous wastes generated during operation. The Authority will implement a written hazardous materials and hazardous waste management plan that will describe responsible parties and procedures for hazardous waste transport, containment, storage and disposal and hazardous material and hazardous waste management BMPs and monitor regulatory compliance of operations (HMW-IAMF#7, HMW-IAMF#10). Through proper disposal at landfills and the safe handling and management of solid and hazardous wastes, the project would minimize impacts from the continuous permanent generation of nonhazardous solid and hazardous waste. Therefore, CEQA does not require mitigation.

3.6.6.3 Energy

Construction of the project would result in temporary and permanent impacts on energy resources, including electricity, natural gas, and petroleum products. Construction of the alternatives would consume energy for demolition of existing structures; clearing and grubbing; handling, storing, hauling, excavating, and placing fill; and construction of aerial structures, bridges, tunnels, road modifications, utility upgrades and relocations, HSR electrical systems, and railbeds. Operation of the project would consume energy for operation of the HSR trains, stations, and maintenance facilities.

No Project Impacts

The population in Santa Clara, San Benito, and Merced Counties is projected to grow through 2040, as discussed in Chapter 2. Demand for energy would increase at a level commensurate with population growth. The region would increase peak and base period electricity demand and would require additional generation and transmission capacity. According to the CEC Energy Assessments Division's Demand Analysis Office, the average annual growth rate for statewide base electricity demand between 2017 and 2027 is forecasted to increase between 0.7 percent (low energy demand) and 1.4 percent (high energy demand) (CEC 2017b). The CEC analysis included forecasted impacts of approved efficiency programs, climate change, electric vehicles, other electrification (including ports and HSR), and demand response (time of use pricing) programs. Energy use in Santa Clara, San Benito, and Merced Counties would be anticipated to trend along the forecasted state average during this same time period.

Without the HSR project, the forecasted population growth would increase pressure to expand highway and airport capacities. The Authority estimates that additional highway and airport projects (up to 4,300 highway lane miles, 115 airport gates, and 4 airport runways) would be needed to achieve equivalent capacity and relieve the increased pressure (Authority 2012a). This expansion of airports and highways would increase VMT and airline flights and increase the demand for energy resources including electricity, natural gas, and petroleum fuels. Under the No Project Alternative, the beneficial effect of reductions in statewide energy consumption related to reductions in VMT and reductions in airline flights from operation of the HSR would not occur.

Under the No Project Alternative, recent development trends are anticipated to continue, leading to impacts on energy. Impacts would include the conversion of existing land to residential, commercial, industrial, and transportation infrastructure to accommodate future growth, placing potential pressures on energy resources. Increased electricity demand would be provided by fossil fuel and renewable electricity sources in California and in other states. Under California SB X1-2 (2011) retail sellers of electricity in California will be required to serve 33 percent of their electricity load with renewable energy by December 31, 2020 (CEC 2017d). Planned development and transportation projects that would occur under the No Project Alternative would likely include various forms of mitigation to address impacts on energy.

Project Impacts

Construction Impacts

Construction of the project would include demolition of existing structures; clearing and grubbing; handling, storing, hauling, excavating, and placing fill; and construction of aerial structures,

bridges, trenches, tunnels, HSR electrical systems, railbeds, and stations and maintenance facilities. Construction activities would involve operation of vehicles for transporting materials, equipment and workers, operation of excavators, graders, TBMs, and other earthmoving equipment for construction in the right-of-way, operation of cranes and other overhead equipment for demolition of buildings and structures and construction in the right-of-way, operation of helicopters that would be used for reconductoring of electric transmission lines to provide electricity to the HSR, and operation of portable generators, pumps, and other construction equipment that would consume petroleum fuels. Construction activities would also include providing lighting for construction work areas and operation of equipment that would consume electricity. Chapter 2 describes construction activities in more detail.

Impact PUE#12: Temporary Consumption of Energy during Construction

Construction of the project would require consumption of petroleum fuels temporarily during the construction period for operation of vehicles to transport materials, equipment, and workers, operation of earthmoving equipment, cranes, and other overhead construction equipment, and operation of helicopters for reconductoring electric transmission lines. Construction of the project would require consumption of electricity to provide lighting to construction work areas and to operate construction equipment.

The amount of energy consumed for construction of the project depends on the characteristics of the alternative, particularly the lengths of elevated, tunnel and trench, and at-grade guideway work. Table 3.6-16 provides a comparison of the project alternatives, which shows the estimated construction energy consumption for the construction of the alternatives between 2022 and 2028, and PG&E network upgrades from 2027 to 2028. The energy consumption estimates for constructing the project alternatives are 22,745 billion Btu for Alternative 1, 28,755 billion Btu for Alternative 2, 24,015 billion Btu for Alternative 3, and 29,290 billion Btu for Alternative 4. The change in tunnel vertical alignment with the TDV would consume the same amount of energy as the alternatives without the TDV. TDV superelevation construction would not change effects on energy compared to the alternatives without the TDV.

Table 3.6-16 Estimated Nonrecoverable Construction-Related Energy Consumption for the Project Alternatives

Year	Gallons per year			Electricity MWh per year	Energy Consumption Billion Btu per year
	Gasoline	Diesel	Jet Fuel[1]		
Alternative 1					
2022	2,195,520	22,379,010	0	37,220	3,340
2023	2,998,245	29,195,440	0	96,790	4,370
2024	3,693,050	33,473,690	0	100,370	5,040
2025	2,736,350	28,644,480	0	100,330	4,265
2026	1,269,370	15,693,310	0	100,280	2,310
2027	1,033,910	15,206,990	250	22,080	2,210
2028	284,450	8,580,280	250	0	1,210
Total	14,209,890	153,173,200	500	457,070	22,745

Year	Gallons per year			Electricity MWh per year	Energy Consumption Billion Btu per year
	Gasoline	Diesel	Jet Fuel[1]		
Alternative 2					
2022	2,735,130	28,257,060	0	37,220	4,210
2023	3,749,550	37,296,170	0	96,790	5,580
2024	4,615,555	42,633,810	0	100,370	6,410
2025	3,206,860	34,153,960	0	100,330	5,080
2026	1,645,340	19,877,040	0	100,280	2,930
2027	1,561,670	22,186,060	250	22,080	3,240
2028	356,500	9,185,400	250	0	1,305
Total	17,870,600	193,589,510	500	457,070	28,755
Alternative 3					
2022	2,119,030	23,108,410	0	37,220	3,430
2023	3,129,215	31,893,810	0	96,790	4,760
2024	3,877,470	35,513,620	0	100,370	5,350
2025	2,684,680	29,488,180	0	100,330	4,375
2026	1,281,910	17,219,965	0	100,280	2,520
2027	1,101.240	16,166,705	250	22,080	2,350
2028	293,140	8,686,490	250	0	1,230
Total	14,486,690	162,077,180	500	457,070	24,015
Alternative 4					
2022	3,128,885	27,029,950	0	37,220	4,090
2023	3,988,430	35,237,200	0	96,790	5,320
2024	4,722,590	42,233,420	0	100,370	6,370
2025	3,826,940	37,784,080	0	100,330	5,650
2026	1,875,750	20,115,895	0	100,280	2,990
2027	1,857,400	24,593,180	250	22,080	3,600
2028	400,340	8,800,860	250	0	1,260
Total	19,800,340	195,794,590	500	457,070	29,290

Source: Authority 2018a
Table values may not sum to totals on account of rounding
[1] Consumption of jet fuel would be for operation of helicopters that would be used to install electrical equipment for reconductoring of transmission towers after the initial Phase I Startup; reconductoring work would begin in 2030 and would be completed within an approximate 24-month timeframe.
MWh = megawatt hour

Although measurable, the energy used for construction would not require significant additional capacity nor significantly increase peak- or base-period demands for electricity. Statewide summer peak electricity demand in 2015 was estimated at approximately 47,188 MW and in 2016 was estimated at approximately 47,529 MW (Cal-ISO 2015, 2016c). Peak electricity consumption for construction is not expected to vary substantially during the construction period; peak

electricity consumption during the construction period would be approximately 76 MW for all alternatives based on 6,000 construction hours over the construction period. Projected peak demand for the Greater Bay Area (which includes Santa Clara County) is projected to be 7,745 MW in 2021 and 8,060 MW in 2026, and projected peak demand in the Greater Fresno Area (which includes Merced County) is projected to be 2,214 MW in 2021 and 2,744 in 2026 (Cal-ISO 2017b). Electricity consumption for construction for all alternatives represents approximately 0.7 percent of the projected reginal peak electricity demand in 2026. Based on estimated peak electricity consumption, no new electric generating capacity would need to be built to supply electricity to meet peak demand for electricity during project construction.

Total gasoline demand for construction of the alternatives would be approximately 14.2 million gallons for Alternative 1, 17.9 million gallons for Alternative 2, 14.4 million gallons for Alternative 3, and 19.8 million gallons for Alternative 4. These values include implementation of the HSR Sustainability Policy and implementation of specific sustainability requirements included by the Authority in the contract for design-build services (PUE-IAMF#1: Design Measures). In 2016, sales of gasoline to end users in California were approximately 4,341,000 gpd (EIA 2017a, 2017b). Gasoline consumption for construction of Alternative 1 represents 0.85 percent of statewide gasoline consumption, 1.13 percent for Alternative 2, 0.91 percent for Alternative 3, and 1.25 percent for Alternative 4.

Total diesel fuel demand for construction of the alternatives would be approximately 153 million gallons for Alternative 1, 193 million gallons for Alternative 2, 162 million gallons for Alternative 3, and 196 million gallons for Alternative 4 over the HSR construction period and the PG&E network upgrades in 2027–2028. These values include implementation of the HSR Sustainability Policy and implementation of specific sustainability requirements included by the Authority in the contract for design-build services (PUE-IAMF#1). In 2016 sales of diesel fuel to end users in California were approximately 1,093,000 gpd (EIA 2017a, 2017b). Project construction diesel fuel consumption therefore represents approximately 12.7 percent of total statewide diesel fuel sales in California for Alternative 1, 16.1 percent for Alternative 2, 13.6 percent for Alternative 3, and 16.4 percent for Alternative 4.

CEQA Conclusion

There would be a less than significant impact under CEQA on electric energy resources from any of the project alternatives because energy consumption during project construction would not place a substantial demand on regional energy supply, require construction of additional electric generating capacity, or substantially increase peak- or base-period electricity demand. Construction of the project would not result in potentially significant environmental impacts due to wasteful, inefficient, or unnecessary consumption of energy resources or conflict with or obstruct a state or local plan for renewable energy or energy efficiency. Based on estimated peak electricity consumption, no new electric generating capacity would need to be built to supply electricity to meet peak demand for electricity during project construction. Construction energy consumption would not require additional petroleum fuel production or distribution capacity to supply gasoline or diesel fuel. The proposed project would decrease overall energy consumption and reduce wasteful, inefficient, and unnecessary consumption of energy resources for other modes of transportation. Energy expended in the construction of the HSR system would be paid back over the course of the payback period in the form of a net decrease in overall transportation energy consumption. After the energy spent building the HSR system is paid back in reduced overall transportation consumption, every year after that would represent energy savings. The project will minimize construction energy consumption through implementation of the Authority's Sustainability Policy and specific sustainability requirements included by the Authority in the contract for design-build services (PUE-IAMF#1). Therefore, CEQA does not require mitigation.

Operations Impacts

Operation of the project would involve scheduled train travel along the HSR line through the project, as well as inspection and maintenance along the track and railroad right-of-way and at stations, on structures, fencing, power system, positive train control, and communications. Chapter 2 describes operations and maintenance activities in more detail.

Impact PUE#13: Continuous Permanent Impacts from Energy Consumption during Operations

Operation of the project would consume energy for operation of the HSR and operation of the stations and maintenance facilities. The project design team estimated that operation of the proposed San Jose Diridon Station would consume 440,680 cubic feet per year of natural gas (approximately 457 million British thermal units [MMBtu] per year) and 2.79 million kWh of electricity per year. The existing San Jose Diridon Station consumed 98,500 cubic feet per year (approximately 102 MMBtu per year) of natural gas and 624,000 kWh per year of electricity (approximately 2,128 MMBtu per year) in 2016 for lighting and operation of electrical equipment. Natural gas and electricity consumption for operation of the San Jose Diridon Station would be the same for all alternatives. The Downtown Gilroy/East Gilroy Station would have natural gas service. Operation of the Downtown Gilroy Station would consume approximately 1.82 million kWh per year and 288,100 cubic feet per year of natural gas. Operation of the East Gilroy Station would consume approximately 1.77 million kWh per year and 280,000 cubic feet per year of natural gas. The existing Gilroy Station consumed approximately 5,040 kWh per year of electricity in 2016 for lighting and operation of electrical equipment. The existing Gilroy Station does not have natural gas service.

Operation of the MOWF and MOWS would also consume electricity and natural gas. The MOWF would consume 1.09 million kWh of electricity per year and 9,500 MMBtu per year (9.16 MMcf) of natural gas. The MOWS would consume 1.37 million kWh per year of electricity and 3,240 MMBtu per year (3.12 MMcf) of natural gas. Estimated electricity consumption for operation of the maintenance facilities would be the same for all alternatives (Authority 2018b).

Vehicle and equipment operations at the MOWF would consume diesel fuel. MOWF vehicle and equipment operations would include operation of locomotives, track treatment machinery, right-of-way inspection and maintenance equipment, and hi-rail construction vehicles on the rail line. MOWF vehicle and equipment operations would consume approximately 224,500 gallons per year of diesel fuel, equivalent to 30,700 MMBtus per year of energy consumption (Authority 2018b).

Operations of any of the project alternatives would use an electrified line supporting electric vehicles with traction power connected to existing PG&E substations (see Chapter 2). For determining HSR energy consumption, analysts assumed use of a Siemens ICE-3 Velaro vehicle operating as two 8-car trainsets and traveling 43.1 million annual train miles by 2040. Table 3.6-17 shows the electricity consumption for HSR operation under two ridership scenarios—medium and high ridership—in 2029 and 2040. Energy consumption for 2029 is estimated to be 502,160 MMBtu per year under the medium ridership scenario and 552,380 MMBtu under the high ridership scenario for all project alternatives. This represents between 0.05 and 0.06 percent of the 2015 statewide electricity consumption. Energy consumption for 2040 is estimated to be 588,120 MMBtu per year under the medium ridership scenario and 646,940 MMBtu per year under the high ridership scenario for all project alternatives, which represents between 0.06 and 0.07 percent of the 2015 statewide electricity consumption.

Medium and High Ridership Scenarios

The medium ridership and high ridership forecasts reflect the uncertainty of the ultimate ridership of the HSR system, which is dependent on many factors, such as the future price of gasoline and population growth. Analysts have evaluated two ridership scenarios to be reflective of a range of expected ridership expected over the coming decades.

Table 3.6-17 HSR Operational Electricity Consumption (Medium and High Ridership Scenarios)

County/Region	HSR Operational Electricity Consumption (MMBtu/year)	
	2029	2040
Medium Ridership Scenario		
Santa Clara, San Benito, and Merced Counties	502,160	588,120
Statewide	4,565,130	5,346,590
High Ridership Scenario		
Santa Clara, San Benito, and Merced Counties	552,380	646,940
Statewide	5,021,650	5,881,250

HSR = high-speed rail
MMBtu = million British thermal units

With the DDV and TDV, HSR train operations could use slightly more electricity due to the increase in speeds in the DDV and TDV areas. There would be adequate electricity supply to meet this slight increase in electricity. The project would still result in a substantial net reduction in energy consumption due to the offsetting effects of reducing vehicular fuel consumption.

Project features will incorporate design elements to minimize electricity consumption (e.g., using regenerative braking, energy-saving equipment on HSR trains and at station and maintenance facilities, implementing energy-saving measures during construction, and automatic train operations to maximize energy efficiency during operations), such that operations will not overburden utility services (PUE-IAMF#1). The design elements would be included in the design-build contract. Additionally, the Authority has adopted a sustainability policy that establishes project design requirements that avoid and minimize energy consumption during operations (Authority 2016a).

The HSR system, including the project, would obtain power from California's electricity grid. The HSR system is expected to require less than 1 percent of the state's future electricity consumption. In 2008, a study performed by Navigant Consulting, Inc. found that while the HSR would be supplied with energy from the California grid, it is not feasible to physically control the flow of electricity from particular sources (Navigant Consulting, Inc. 2008). However, it would be feasible for the Authority to obtain the quantity of power required for the HSR from 100 percent clean, renewable energy sources through a variety of mechanisms, such as paying a clean-energy premium for consumed electricity. An industry survey in April 2013 indicated that there is sufficient renewable energy capacity to meet the system demand (Authority and FRA 2017). Under the 2013 Policy Directive POLI-PLAN-03, the Authority has adopted a goal to purchase 100 percent of the HSR system's power from renewable energy sources (Authority 2016a).

The HSR system would decrease automobile VMT and reduce energy consumption by automobiles, resulting in an overall reduction in energy use for intercity and commuter travel. Table 3.6-18 shows the change in estimated daily VMT and associated energy consumption with and without the HSR system for the medium and high ridership scenarios for 2029 and 2040. HSR operation would reduce daily VMT in Santa Clara, San Benito, and Merced Counties by 333 to 450 million VMT per year in 2029 for the medium and high ridership scenarios, and by 600 to 816 million VMT per year in 2040 for the medium and high ridership scenarios. These values, together with associated average daily speed estimates, were used to develop predictions of the change in energy use associated with VMT for the three counties. The reduction in energy use from the VMT reduction in Santa Clara, San Benito, and Merced Counties in 2029 ranges from 1,026,000 to 1,384,870 MMBtu per year under the medium and high ridership scenarios. The reduction in energy use from the VMT reduction in Santa Clara, San Benito, and Merced Counties in 2040 ranges from 1,644,010 to 2,303,200 MMBtu per year for all of the alternatives under the medium and high ridership scenarios.

Table 3.6-18 Estimated Changes in Vehicle Miles Traveled and Energy Consumption (Medium and High Ridership Scenarios)[1] [2]

County/Region	Existing Conditions (2015)		Future Conditions (2029)		Future Conditions (2040)	
	VMT	Energy Consumption (MMBtu/year)	Change in VMT between 2029 Plus Project and 2029 No Project	Change in Energy Consumption between 2029 Plus Project and 2029 No Project (MMBtu/year)	Change in VMT between 2040 Plus Project and 2040 No Project	Change in Energy Consumption between 2040 Plus Project and 2040 No Project (MMBtu/year)
Medium Ridership Scenario						
Santa Clara	10,312,374,120	49,193,780	(130,784,260)	(411,530)	(229,877,270)	(643,210)
San Benito	620,032,420	2,927,440	(88,111,050)	(271,290)	(170,347,440)	(482,620)
Merced	1,239,904,080	5,712,100	(114,392,300)	(343,180)	(200,035,650)	(518,180)
Region	**12,172,310,620**	**57,833,330**	**(333,287,610)**	**(1,026,000)**	**(600,260,360)**	**(1,644,010)**
Statewide	**205,015,920,150**	**922,880,370**	**(2,266,597,310)**	**(6,675,390)**	**(4,768,401,550)**	**(7,412,180)**
High Ridership Scenario						
Santa Clara County	10,283,778,970	10,060,102,630	(175,990,310)	(553,780)	(310,866,450)	(869,830)
San Benito County	613,186,470	444,285,230	(119,948,290)	(369,310)	(234,739,760)	(657,150)
Merced County	1,217,771,430	1,023,513,300	(153,925,340)	(461,780)	(269,980,880)	(776,220)
Region	**12,114,736,870**	**11,527,901,160**	**(449,863,940)**	**(1,384,870)**	**(815,587,090)**	**(2,303,200)**
Statewide	**203,997,417,630**	**199,280,213,990**	**(3,137,576,250)**	**(4,070,230)**	**(6,555,992,320)**	**(16,666,660)**

Source: Authority 2019
(Parenthesis) indicate negative values
Table values may not sum to totals on account of rounding
[1] Based on energy consumption for operation of the HSR; these values do not include electricity consumption for operation of the stations and maintenance facilities.
2 Analysts developed the two scenarios (medium ridership and high ridership) for three different years: 2015 Existing Conditions, 2029 Plus Project conditions (opening), and 2040 Plus Project conditions (Phase 1 of the HSR system horizon 2040). Both scenarios are based on the level of ridership as presented in Connecting and Transforming California, 2016 Business Plan (Authority 2016b). These scenarios assume different background conditions. For example, forecast trends in demographics and travel costs can influence ridership for any HSR scenario. The medium scenario was developed using the "most likely" values of all inputs to the HSR ridership forecasting model, while the high scenario used inputs that were set at values that result in ridership at the 75th percentile of the range considered in the ridership risk analysis. The 2016 Business Plan provides additional detail on the travel forecasts and risk analysis.
HSR = high-speed rail
MMBtu = million British thermal units
VMT = vehicle miles traveled

In addition, the number of airplane flights statewide (intrastate) would decrease with implementation of the HSR system when analyzed against the future No Project and existing conditions because some travelers would choose to use the HSR rather than fly to their destination. Table 3.6-19 shows the reduction in the number of airplane flights associated with the project alternatives for the medium and high ridership scenarios.

Table 3.6-19 Estimated Changes in Airplane Flights and Energy Consumption (Medium and High Ridership Scenarios) [1] [2]

County/ Region	Existing Conditions (2015)		Future Conditions (2029)		Future Conditions (2040)	
	Flights	Energy Consumption (MMBtu/year)	Change in Flights between 2029 Plus Project and 2029 No Project	Change in Energy Consumption between 2029 Plus Project and 2029 No Project (MMBtu/year)	Change in Flights between 2040 Plus Project and 2040 No Project	Change in Energy Consumption between 2040 Plus Project and 2040 No Project (MMBtu/year)
Medium Ridership Scenario						
Bay Area	91,120	10,932,600	(20,660)	(2,478,640)	(44,000)	(5,279,340)
Statewide	268,570	32,221,210	(52,140)	(6,255,290)	(111,370)	(13,362,110)
High Ridership Scenario						
Bay Area	85,060	10,205,660	(22,640)	(2,716,740)	(42,120)	(5,052,810)
Statewide	250,280	30,026,780	(57,640)	(6,915,460)	(107,150)	(12,855,700)

Source: Authority 2019
(Parenthesis) indicate negative values
[1] Based on energy consumption for operation of the HSR trains; these values do not include electricity consumption for operation of the stations and maintenance facilities.
[2] Analysts developed the two scenarios (medium ridership and high ridership) for three different years: 2015 Existing Conditions, 2029 Plus Project conditions (opening), and 2040 Plus Project conditions (Phase 1 of the HSR system horizon 2040). Both scenarios are based on the level of ridership as presented in Connecting and Transforming California, 2016 Business Plan (Authority 2016b). These scenarios assume different background conditions. For example, forecast trends in demographics and travel costs can influence ridership for any HSR scenario. The medium scenario was developed using the "most likely" values of all inputs to the HSR ridership forecasting model, while the high scenario used inputs that were set at values that result in ridership at the 75th percentile of the range considered in the ridership risk analysis. The 2016 Business Plan provides additional detail on the travel forecasts and risk analysis.
MMBtu = million British thermal units

Analysts estimated the number of air trips removed as a result of the HSR system by using the travel demand modeling analysis conducted for the project. The average full flight cycle fuel consumption rate for aircraft was based on the profile of aircraft currently servicing the San Francisco to Los Angeles airline corridor. Operation under the medium ridership scenario would reduce energy consumption from airplane flights by 2,478,640 MMBtu per year for the Bay Area and by 6,255,290 MMBtu per year statewide in 2029. Operation under the high ridership scenario would reduce energy consumption from airplane flights by 2,716,740 MMBtu per year for the Bay Area and by 6,915,460 MMBtu per year statewide in 2029. Operation under the medium ridership scenario would reduce energy consumption from airplane flights by 5,279,340 MMBtu per year for the Bay Area and by 13,362,110 MMBtu per year statewide in 2040. Operation under the high ridership scenario would reduce energy consumption from airplane flights by 5,052,810 MMBtu per year for the Bay Area and by 12,855,700 MMBtu per year statewide in 2040.

Table 3.6-20 and Table 3.6-21 provide a summary of energy consumption for project operation, as well as the resulting changes in regional and statewide energy consumption from the reduction in VMT and airplane flights that would occur as a result of operation of the HSR for 2029 and 2040. Operation of the project in 2029 would reduce regional energy consumption by 3,002,480 MMBtu per year under the medium ridership scenario and by 3,549,230 MMBtu per year under the high ridership scenario. Operation of the project in 2029 would reduce statewide energy consumption by 8,365,550 MMBtu per year under the medium ridership scenario and by 5,964,040 MMBtu per year under the high ridership scenario. Operation of the project in 2040 would reduce regional energy consumption by 6,335,230 MMBtu per year under the medium ridership scenario and by 6,709,070 MMBtu per year under the high ridership scenario. Operation of the project in 2040 would reduce statewide energy consumption by 15,427,700 MMBtu per year under the medium ridership scenario and by 23,641,110 MMBtu per year under the high ridership scenario.

Construction of the project alternatives would consume energy including electricity and fuels. As shown in Table 3.6-20 and Table 3.6-21, construction of the project alternatives would consume between 22,760,000 MMBtu and 29,290,000 MMBtu. The energy consumed during construction would be offset by the savings in energy consumption from the reduction in VMT and flights. It would take between 6.4 and 9.6 years of regional energy reductions to recoup the energy consumed during construction of the project alternatives and between 2.7 to 4.9 statewide energy reductions to recoup the energy consumed during construction of the project alternatives. The payback period of regional energy reductions for the energy consumption for construction would range from a low of 7.6 years under the medium ridership scenario and 6.4 years under the high ridership scenario for Alternative 1, and a high of 9.8 years under the medium ridership scenario and 8.3 years under the high ridership scenario for Alternative 4.

Operation of the project would not require construction of significant additional electrical generation capacity nor would operation significantly increase peak- or base-period demands for electricity. The project would increase electricity demand. Because of the anticipated times of peak rail travel, impacts on electricity generation and transmission facilities would be particularly focused on peak electricity demand periods (4:00 p.m. to 6:00 p.m.). According to the Statewide Program EIR/EIS (Authority and FRA 2005), the HSR would increase peak electricity demand on the state's generation and transmission infrastructure by an estimated 480 MW. Based on the assumption that this peak demand would be evenly spread throughout the system, the Project Section (17 percent of total system) would require approximately 82 MW of additional peak capacity, and the Project Section would result in approximately 19.7 MW base electricity demand (588,120 MMBtu per year) for the medium ridership scenario and approximately 21.6 MW base electricity demand (646,940 MMBtu per year) for the high-ridership scenario. Although electricity supply in 2040 cannot be predicted, given the planning period available and the known demand from the project, energy providers have sufficient information to include the HSR in their demand forecasts.

Cal-ISO has projected growth in electricity demand through 2040 in planning documents and projects the need for an additional 86,000 MW of peak summer capacity between 2017 and 2040 to meet the projected 2040 demand with an adequate reserve margin (Cal-ISO 2015). The Authority expects that the planned additions in capacity projected by Cal-ISO would be met by electricity providers and that available capacity in 2040 would therefore be sufficient to supply electricity for project operations. Based on the projected increase in electricity demand and projected addition of capacity, electricity consumption for project operations would represent approximately 0.94 percent of energy demand in Santa Clara, San Benito, and Merced Counties in 2040 (Table 3.6-17).

Project operations would not require construction of appreciable additional capacity to supply fuel The project would minimize operation energy consumption by adopting and incorporating in the HSR project design utilities and design elements that would minimize electricity consumption (e.g., using regenerative braking, energy-saving equipment on HSR trains and at station facilities, and implementing automatic control of train operations to maximize energy efficiency during operations).

Table 3.6-20 Summary of Regional Changes in Energy Consumption (Medium and High Ridership Scenarios) [1]

Construction Energy Consumption (Billion Btu)			
Alt 1	Alt 2	Alt 3	Alt 4
22,760	28,750	24,010	29,290

Project Operation Energy Consumption (MMBtu/year)		Change in Energy Consumption from Reduced VMT (MMBtu/year)		Change in Energy Consumption from Reduced Airline Flights (MMBtu/year)		Total Reduction in Energy Consumption (MMBtu/year)		Payback Period (years) (2029)			
2029	2040	2029	2040	2029	2040	2029	2040	Alt 1	Alt 2	Alt 3	Alt 4
Medium Ridership Scenario											
502,160	588,120	(1,026,000)	(1,644,010)	(2,478,640)	(5,279,340)	(3,002,480)	(6,335,230)	7.6	9.6	8.0	9.8
High Ridership Scenario											
552,380	646,940	(1,384,870)	(2,303,200)	(2,716,740)	(5,052,810)	(3,549,230)	(6,709,070)	6.4	8.1	6.8	8.3

Source: Authority 2019
(Parenthesis) indicate negative values
[1] Analysts developed the two scenarios (medium ridership and high ridership) for three different years: 2015 Existing Conditions, 2029 Plus Project conditions (opening), and 2040 Plus Project conditions (Phase 1 of the HSR system horizon 2040). Both scenarios are based on the level of ridership as presented in Connecting and Transforming California, 2016 Business Plan (Authority 2016b). These scenarios assume different background conditions. For example, forecast trends in demographics and travel costs can influence ridership for any HSR scenario. The medium scenario was developed using the "most likely" values of all inputs to the HSR ridership forecasting model, while the high scenario used inputs that were set at values that result in ridership at the 75th percentile of the range considered in the ridership risk analysis. The 2016 Business Plan provides additional detail on the travel forecasts and risk analysis.
MMBtu = million British thermal units
VMT = vehicle miles traveled

Table 3.6-21 Summary of Statewide Changes in Energy Consumption (Medium and High Ridership Scenarios) [1]

Construction Energy Consumption (Billion Btu)			
Alt 1	Alt 2	Alt 3	Alt 4
22,760	28,750	24,010	29,290

Project Operation Energy Consumption (MMBtu/year)		Change in Energy Consumption from Reduced VMT (MMBtu/year)		Change in Energy Consumption from Reduced Airline Flights (MMBtu/year)		Total Reduction in Energy Consumption (MMBtu/year)		Payback Period (years) (2029)			
2029	2040	2029	2040	2029	2040	2029	2040	Alt 1	Alt 2	Alt 3	Alt 4
Medium Ridership Scenario											
4,565,130	5,346,590	(6,675,390)	(7,412,180)	(6,255,290)	(13,362,110)	(8,365,550)	(15,427,700)	2.7	3.4	2.9	3.5
High Ridership Scenario											
5,021,650	5,881,250	(4,070,230)	(16,666,660)	(6,915,460)	(12,855,700)	(5,964,040)	(23,641,110)	3.8	4.8	4.0	4.9

Source: Authority 2019
(Parenthesis) indicate negative values
MMBtu = million British thermal units
VMT = vehicle miles traveled
[1] Analysts developed the two scenarios (medium ridership and high ridership) for three different years: 2015 Existing Conditions, 2029 Plus Project conditions (opening), and 2040 Plus Project conditions (Phase 1 of the HSR system horizon 2040). Both scenarios are based on the level of ridership as presented in Connecting and Transforming California, 2016 Business Plan (Authority 2016b). These scenarios assume different background conditions. For example, forecast trends in demographics and travel costs can influence ridership for any HSR scenario. The medium scenario was developed using the "most likely" values of all inputs to the HSR ridership forecasting model, while the high scenario used inputs that were set at values that result in ridership at the 75th percentile of the range considered in the ridership risk analysis. The 2016 Business Plan provides additional detail on the travel forecasts and risk analysis.

CEQA Conclusion

There would be a less than significant impact under CEQA because operation under all of the alternatives would result in a net decrease in transportation energy consumption from other modes of transportation. The proposed project results in energy savings, alleviates demand on energy resources, and encourages the use of efficient transportation alternatives, and thereby the project would have a beneficial effect. Operation of the HSR would result in a reduction in VMT in Santa Clara, San Benito, and Merced Counties and would result in a reduction in airplane flights in the Bay Area in which the project is located. The reduction in energy consumption for other modes of transportation that would result from operation of the HSR exceeds the increase in energy consumption for HSR operation of the in the project extent, resulting in a net decrease in statewide energy consumption. As a result, operation of the HSR would result in a net benefit to energy resources. Because the project would minimize energy consumption for operations, operation energy consumption would not place a substantial demand on regional energy supply or require substantial additional capacity or substantially increase peak- and base-period electricity demand. Through effective energy-saving design features and net reduction in energy consumption for transportation modes, there would be a beneficial impact on energy resources. Therefore, CEQA does not require mitigation.

3.6.7 Mitigation Measures

The following mitigation measure would be implemented for Alternative 1 and Alternative 2 to address impacts on public utilities.

Mitigation Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
PUE-MM#1: Replace Percolation Ponds at SCRWA Treatment Plant	X	X	N/A	N/A

N/A = not applicable

PUE-MM#1: Replace Percolation Ponds at SCRWA Treatment Plant

Prior to the commencement of any construction of Alternatives 1 or 2, the contractor will construct percolation ponds on existing SCRWA-owned agricultural land adjacent to the existing percolation ponds or on other land owned or acquired by the SCRWA to replace the net percolation capacity of the percolation ponds taken by project construction. The contractor will construct percolation ponds to provide at least the same amount of net percolation capacity and will demonstrate to the SCRWA that the net percolation capacity of the replacement ponds constructed will be at least equal to the net percolation capacity of the removed ponds. The replacement percolation ponds will be commissioned and placed into service prior to closure of the existing percolation ponds. PUE-MM#1 will be implemented by the Authority, SCRWA, and the contractor, with oversight by the RWQCB, the oversight agency for the SCRWA.

Percolation Rate Study

The Authority will provide full funding to the SCRWA to conduct a study of the percolation rates of land owned by the SCRWA or available for acquisition by the SCRWA for the purposes of replacement of the percolation pond capacity. The SCRWA and the contractor will prepare a work plan for presentation to the RWQCB, the oversight agency for the SCRWA, for review and approval prior to installation of groundwater monitoring wells or commencement of other project work. The RWQCB must grant approval before any project work takes place.

Percolation rates are different for different soils and stratigraphies, and generally decrease from south to north in the area around the SCRWA facility. Percolation tests will be conducted to assess the potential locations and acreage of the replacement percolation ponds. Location(s) and acreage of the parcels needed for the replacement of the net percolation capacity will be determined based on the results of the study; the total acreage of replacement may exceed the 51 acres taken by the alignment construction, or may be less than the 51 acres, depending on soil characteristics and other factors. The same percolation rate study may also be used to identify additional parcels for potential expansion of the SCRWA wastewater treatment capacity;

the current wastewater treatment capacity of the SCRWA WWTP is 9 mgd. The study will also be used to determine the location(s) of replacement monitoring wells to replace the two closed wells affected by construction of Alternatives 1 and 2, and to determine the locations of additional wells that will need to be installed for the purposes of monitoring the replacement percolation ponds.

Parcels that are adjacent to the existing percolation ponds are primarily agricultural land, and therefore the percolation rate study will include the construction and operation of groundwater monitoring wells to establish existing groundwater quality for parcels within and adjacent to the potential construction area for the replacement percolation ponds. The RWQCB may require installation of three or more monitoring wells (typically the wells will need to be about 50 feet deep in the areas near the SCRWA facility), and typically the RWQCB requires evaluation of groundwater quality and groundwater gradient data and preparation of an engineering report. SCRWA will conduct or oversee the study, installation and operation of monitoring wells, and preparation of the engineering report, at SCRWA's discretion, and fully funded by the Authority.

Preliminary Design and Construction Plan

Based on the results of the investigations and monitoring studies, the contractor, overseen by the SCRWA, will develop a preliminary design and construction plan for construction of replacement percolation ponds to replace by a ratio of at least 1:1 the net percolation capacity of the 51 acres of existing ponds that will be taken by the alignment construction. SCRWA will determine based on the results of the investigations and monitoring studies the location(s) and approximate acreage of the replacement ponds and the extent to which the replacement ponds could be built on land already owned by the SCRWA, and the extent (if any) to which the SCRWA will need to acquire land from private landowners or other parties for construction of the replacement ponds. The Authority will provide assistance to the SCRWA for acquisition of permits and approvals for required land acquisition and will provide full funding for any required land acquisition.

Detailed Design and Construction

The contractor will submit the preliminary design and construction plan to the SCRWA for review and approval prior to commencement of detailed design and construction. The SCRWA will coordinate with and provide oversight of the contractor for detailed design, construction, permitting, performance testing, and commissioning of the replacement ponds and all required ancillary equipment including pipelines, pumps, monitoring wells, other mechanical and electrical equipment, access roads, fences, and enclosures. The SCRWA will oversee the contractor's design, permitting, construction, performance testing, and commissioning of the percolation ponds. Performance testing guarantees will be included in the contractual agreement between the contractor and SCRWA. Performance guarantees will include successful acquisition of all permits and approvals required for construction and operation of the replacement percolation ponds and demonstration that the replacement percolation ponds, in operation, provide a net percolation capacity of at least a 1:1 replacement of the net percolation capacity of the ponds that will be taken by the alignment construction.

The Authority will enter into a contractual agreement with the SCRWA to provide the SCRWA with full funding for all costs associated with the removal of the existing percolation ponds and associated facilities equipment as well as construction of the replacement percolation ponds and associated facilities and equipment, including pre-construction studies, land acquisition (if any), and design, permitting, construction, performance testing, and commissioning of the replacement ponds. The Authority will not be responsible under the contractual agreement with the SCRWA for costs associated with operation of the replacement percolation ponds.

Mitigation Measure Performance Guarantees

This mitigation measure will be effective in replacing the net percolation capacity of the SCRWA percolation ponds that will be taken by the alignment construction, maintaining the SCRWA WWTP's capacity, and maintaining groundwater quality within permit limitations. Construction of replacement ponds of sufficient capacity to replace by at least 1:1 the net percolation capacity of the ponds that will be taken by the Alternative 1 and Alternative 2 alignment construction will maintain the treatment capacity of the SCRWA WWTP and will not result in any decrease in

wastewater treatment capacity or result in reduction in the quality of the wastewater treatment. The contractor and the SCRWA will establish performance guarantees that the design, construction, and operation of the replacement ponds meets the performance criteria including the effective replacement of the net percolation capacity of the existing ponds. The RWQCB will require installation of groundwater monitoring wells prior to replacement percolation pond construction to establish existing groundwater quality and will require continued operation of groundwater monitoring wells to monitor operation of the replacement ponds and maintain groundwater quality in accordance with established operating permit conditions and the SCRWA's monitoring plan. The contractual agreement between the contractor and the SCRWA will require that the replacement percolation ponds be fully commissioned and commence full capacity operation prior to decommissioning and removal of the existing percolation ponds in order to avoid any reduction of treatment capacity or interruption of service. The construction and operation of replacement ponds will therefore not result in permanent effects on the operation of public utilities.

Secondary Impacts of Mitigation Measures

Implementing PUE-MM#1 would result in secondary impacts resulting from construction of the replacement ponds. Replacement pond construction will require conversion of existing land into percolation ponds, and may require acquisition of land that is not already owned by the SCRWA. Studies conducted by the contractor and overseen by the SCRWA will determine the total acreage of land that will need to be converted, and also determine the need for the SCRWA to acquire land that the SCRWA does not currently own. The existing ponds that would be taken by Alternative 1 and Alternative 2 alignment construction comprise approximately 51 acres; the amount of land that will be converted for construction of the replacement ponds could be either more or less than 51 acres depending upon the results of the studies and the design of the replacement percolation ponds. The amount of land that the SCRWA will need to acquire (if any) will also depend upon the results of the studies, including the results of percolation tests of various land parcels. Implementation of PUE-MM#1 would therefore result in loss of an amount of existing agricultural land, potential loss of land that is currently in other uses, and potential acquisition of land from private landowners or other parties and displacement of current land uses.

Implementation of PUE-MM#1 would also result in secondary air quality, noise, transportation (traffic), water quality, and waste management effects related to decommissioning and removal of the existing percolation ponds and construction of the replacement ponds. Air quality effects would result from fugitive dust generated from removal of the existing ponds and construction of the replacement ponds and operation of construction vehicles on unpaved roads. Air quality effects would also result from construction equipment (engine) air emissions. Noise effects would result from noise generated by operation of construction equipment and from decommissioning and construction activities. Transportation (traffic) effects would result from operation of workers' personal vehicles, construction equipment, and other vehicles, including for delivery vehicles, on public roads in the vicinity of the existing ponds and the replacement ponds. Solid waste that would require disposal or reuse could be generated from cut-and-fill activities needed for removal of the existing ponds and construction of the replacement ponds. Water quality effects could result from surface water and sediment runoff from construction sites.

Replacement of the percolation ponds and removal of the existing percolation ponds is mitigation. Construction of new percolation ponds and removal of the existing percolation ponds will be conducted by a municipal agency (or by municipal agency contractors) under appropriate permit conditions issued by state and local regulatory agencies. Reconstruction of the percolation ponds and demolition of the existing percolation ponds will be conducted in accordance with state and local regulatory requirements and in compliance with permit conditions. Therefore, there would be no significant secondary impacts from demolition and construction of the percolation ponds.

3.6.8 Impact Summary for NEPA Comparison of Alternatives

As described in Section 3.1.6.4, the effects of project actions under NEPA are compared to the No Project condition when evaluating the impact of the project on the resource. The

determination of effect was based on the context and intensity of the change that would be generated by construction and operation of the project. Table 3.6-22 compares the project impacts by alternative, followed by a summary of the impacts.

Table 3.6-22 Comparison of Project Alternative Impacts for Public Utilities and Energy

Impacts	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Public Utilities				
Impact PUE#1: Planned and Accidental Temporary Interruption of Utility Service	Planned and accidental interruptions to utility services would be temporary and for short durations. There are 212 major utility lines within the RSA for Alternative 1.	Same as Alternative 1, except there are 303 major utility lines within the RSA for Alternative 2.	Same as Alternative 1, except there are 202 major utility lines within the RSA for Alternative 3.	Same as Alternative 1, except there are 404 major utility lines within the RSA for Alternative 4.
Impact PUE#2: Temporary Impacts from Water Use	Construction would require 4,339 acre-feet of water, which is 10 percent of the current water usage for the land within the project footprint.	Construction would require 4,205 acre-feet of water which is 9 percent of the current water usage for the land within the project footprint.	Construction would require 4,555 acre-feet of water, which is 10 percent of the current water usage for the land within the project footprint.	Construction would require 4,426 acre-feet of water, which is 10 percent of the current water usage for the land within the project footprint.
Impact PUE#3: Reduced Access to Existing Utilities in the HSR Right-of-Way	Access to utilities would be provided during and after construction of all project alternatives.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact PUE#4: Existing Major Utilities Requiring Relocation or Removal	Relocation of 158 major utility lines and protection in place of 46 utility lines; removal, extension, realignment/ abandonment of 8 utility lines. Displacement of 3 percolation ponds comprising 51 acres at SCRWA WWTP.	Relocation of 235 major utility lines and protection in place of 61 major utility lines; removal, extension, realignment/ abandonment of 7 utility lines. Displacement of 3 percolation ponds comprising 51 acres at SCRWA WWTP.	Relocation of 150 major utility lines and protection in place of 45 major utility lines; removal, extension, realignment/ abandonment of 7 utility lines. No impact on the SCRWA WWTP.	Relocation of 176 major utility lines and protection in place of 165 major utility lines; removal, extension, realignment/ abandonment of 17 utility lines. No impact on the SCRWA WWTP.

Impacts	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact PUE#5: Temporary Impacts from Construction of New Utility Infrastructure	Alternative 1 includes the construction of three TPSSs and co-located electric utility switching stations; each TPSS site occupying up to 2 acres; TPSS Site 4 would be built at one of two alternative sites in Gilroy. Alternative 1 includes reconductoring of three 115-kV power lines; construction of new potable water and wastewater lines to stations and maintenance facilities; construction of new stormwater management infrastructure in the Morgan Hill and Gilroy Subsection. New storm drainage infrastructure would be built in the Pacheco Pass Subsection.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Impact PUE#6: Temporary Impacts from Stormwater and Wastewater Generation during Construction	Construction would require 4,339 acre-feet of water resulting in potential generation of 0.41 mgd of wastewater, which is less than 0.2 percent of the total wastewater treatment capacity within the RSA.	Construction would require 4,205 acre-feet of water resulting in potential generation of 0.39 mgd of wastewater, which is less than 0.2 percent of the total wastewater treatment capacity within the RSA.	Construction would require 4,555 acre-feet of water resulting in potential generation of 0.45 mgd of wastewater, which is less than 0.25 percent of the total wastewater treatment capacity within the RSA.	Construction would require 4,426 acre-feet of water resulting in potential generation of 0.40 mgd of wastewater, which is less than 0.2 percent of the total wastewater treatment capacity within the RSA
Impact PUE#7: Temporary Generation of Solid Waste and Hazardous Waste during Construction	Construction would result in 199,300 cubic yards of solid waste from demolition activities.	Construction would result in 325,000 cubic yards of solid waste from demolition activities.	Construction would result in 184,800 cubic yards of solid waste from demolition activities.	Construction would result in 90,100 cubic yards of solid waste from demolition activities.

Impacts	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact PUE#8: Continuous Permanent Impacts from Water Use	Operations would consume 224,200 gpd including operation of stations and maintenance facilities. Project features will effectively recycle and reuse water where possible and reduce overall consumption	Same as Alternative 1.	Operations would consume 223,800 gpd; East Gilroy Station water consumption would be approximately 500 gpd less than for the Downtown Gilroy Station. Other water consumption would be the same as Alternative 1.	Same as Alternative 1.
Impact PUE#9: Continuous Permanent Impacts from Wastewater Generation	Operations would generate 224,200 gpd of wastewater including the operation of stations and maintenance facilities. Wastewater would be disposed of properly and handled safely and would not exceed the available treatment capacity of local wastewater facilities.	Same as Alternative 1.	Operations would generate 223,800 gpd of wastewater; East Gilroy Station wastewater generation would be approximately 500 gpd less than for the Downtown Gilroy Station. Other wastewater generation would be the same as Alternative 1.	Same as Alternative 1.
Impact PUE#10: Continuous Permanent Impacts on Storm Drainage Facilities	The impact on stormwater drainage facilities would not require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.	Same as for Alternative 1	Same as for Alternative 1	Same as for Alternative 1
Impact PUE#11: Continuous Permanent Generation of Solid Waste and Hazardous Waste	Operations would generate approximately 2,560 cubic yards of solid waste annually. Solid waste and hazardous waste generation from operations would not exceed available disposal capacity.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.

Impacts	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Energy				
Impact PUE#12: Temporary Consumption of Energy during Construction	Construction would require 22,745 billion Btu.	Construction would require 28,755 billion Btu.	Construction would require 24,015 billion Btu.	Construction would require 29,290 billion Btu.
Impact PUE#13: Continuous Permanent Impacts from Energy Consumption during Operations	Operations would result in a net decrease in regional energy consumption of 6,335,230 MMBtu per year for medium ridership scenario and a net decrease of 6,709,070 MMBtu per year for the high ridership scenario in 2040. It would take approximately 7.6 years and 6.4 years of regional energy reductions to recoup the energy consumed during construction under the medium and high ridership scenarios, respectively.	Same as Alternative 1, with the exception of the payback period for construction energy, which would be 9.6 and 8.1 years under the medium and high ridership scenarios, respectively.	Same as Alternative 1, with the exception of the payback period for construction energy, which would be 8.0 and 6.8 years under the medium and high ridership scenarios, respectively.	Same as Alternative 1, with the exception of the payback period for construction energy, which would be 9.8 and 8.3 years under the medium and high ridership scenarios, respectively.

Btu = British thermal unit
gpd = gallons per day
HSR = high-speed rail
MMBtu = million British thermal units
RSA = Resource Study Area
kV = kilovolt
SCRWA = South County Regional Wastewater Authority
TPSS = traction power substation
WWTP = wastewater treatment plant

The potential for interruptions to utility services would be greatest under Alternative 4, followed by Alternative 2, Alternative 1, and Alternative 3, depending on each alternative's proximity to major utility lines. Utility interruptions during construction would be temporary, and because users would receive advance notice of interruptions, any inconvenience to residents and businesses from relocation activities would be minimal. Utility identification would be completed prior to commencement of construction, thereby minimizing accidental utility interruptions.

Table 3.6-13 summarizes the number of major utility lines that would need to be permanently relocated or protected in place, or removed, extended, abandoned in place, or realigned during construction of each project alternative. Alternative 4 would result in the most (404) utility conflicts, while Alternative 3 would result in the fewest (202) utility conflicts. Alternative 1 would result in 212 utility conflicts. Alternative 2 would result in 303 utility conflicts, including relocations and protections in place and removals, extensions, abandonment in place, and realignments.

Construction of the project would not result in reduced access to existing utilities in the HSR right-of-way or in permanent conflicts with existing major utilities requiring protection in place, relocation, or removal. All conflicting utilities would be removed, relocated, abandoned in place, or protected in place during construction, and therefore there would be no permanent conflicts with utilities resulting from project construction. Project features include coordination with utility service providers to avoid permanent conflicts with utilities and coordination with service providers to allow for the continued access for maintenance of utility lines remaining within the right-of-way during operation. Relocations and reinstallation of utility lines would be conducted by the contractor and the utility service provider in accordance with design standards and regulatory requirements including CPUC General Order 131-D for electrical systems. Construction of new water, wastewater, or stormwater infrastructure would adhere to permit requirements and local water management authority standards and permit requirements, thereby minimizing impacts from construction of new utility infrastructure.

Construction of the project alternatives has the potential to affect existing utility facilities temporarily. The project alternatives would require the relocation of 158 major utility lines under Alternative 1, 235 major utility lines under Alternative 2, 150 major utility lines under Alternative 3, and 176 major utility lines under Alternative 4. The project alternatives would also require the protection in place of between 45 and 165 additional major utility lines. Alternative 2 would require the greatest number of utility relocations and Alternative 4 would require the greatest number of utility protections in place. In addition, under Alternative 2, the need to depress roadways to grade-separate the HSR alignment along Monterey Road, would require the installation of pump stations to maintain current functions of gravity-driven utilities lines such as storm drains and sanitary sewers within those roadway rights-of-way. Alternatives 1 and 2 would require the construction of new stormwater management infrastructure in the Morgan Hill and Gilroy Subsection and would result in the acquisition and displacement of 51 acres of wastewater treatment percolation ponds at SCRWA WWTP in Gilroy. Alternative 3 and Alternative 4 would not require the construction of new stormwater management infrastructure or affect the SCRWA WWTP.

Construction of the project alternatives would use from 4,205 to 4,555 acre-feet of water for the construction period. Alternative 1 would require 4,339 acre-feet, Alternative 2 would require 4,205 acre-feet, Alternative 3 would require 4,555 acre-feet, and Alternative 4 would require 4,426 acre-feet. The contractor would implement the Authority's Water Conservation Guidance to minimize use of potable water for construction-related activities.

Wastewater would be generated from construction activities including concrete preparation excavation, dewatering, and TBM operation. The amount of water that would be consumed for operation of concrete batch plants, construction (including excavation), and TBM operation is assumed to be equal to the amount of wastewater that would be generated from those activities; the amount of additional wastewater that would be generated from dewatering activities would vary depending on site characteristics and therefore has not been separately estimated — Alternative 3 would generate the greatest amount of wastewater (4,251 acre-feet), while Alternative 2 would generate the least amount of wastewater (3,905 acre-feet), assuming all of the water used in construction results in wastewater generation.

Construction activities would not result in impacts on local wastewater treatment capacity because there would be sufficient capacity to treat the wastewater generated under any of the alternatives. Project features, including BMPs, implementation of the SWPPP, and conformance with the CGP and local wastewater management jurisdiction permit requirements, will minimize water use and thereby minimize wastewater generation.

Construction of the project would generate solid waste and hazardous waste from demolition of buildings and structures, excavation, and operation of construction equipment. The amount of solid waste generated would range from 90,100 cubic yards under Alternative 4 to 325,000 cubic yards under Alternative 2. Through implementation of a demolition plan, proper disposal at landfills, and the safe handling and management of hazardous materials, project features will

minimize impacts from the temporary generation of solid and hazardous wastes. Existing landfills have adequate capacity for disposal of C&D material under all alternatives.

Operation of the project would not result in permanent impacts from water use. Potable and nonpotable water would be used for operation of the stations and maintenance facilities. Water use for operations would not result in water use impacts because construction of the project would result in a net decrease in water consumption for the proposed project as compared to existing land uses (e.g., agricultural uses,) of the land that would be used for the project footprint, as shown in Appendix 3.6.C, Water Use Assessment. Therefore, sufficient water supplies would be available to serve operation of the project and reasonably foreseeable future development during normal, dry, and multiple dry years. In addition, because project features allow for use of recycled or reclaimed water for nonpotable uses where available that will minimize the use of water resources, the amount of water consumed for project operations could be less than that estimated for this EIR/EIS analysis.

Operation of the project would not result in impacts from wastewater generation because wastewater generated at stations and maintenance facilities during operations would be discharged to the sewer system and would not exceed the available treatment capacity of local WWTPs or result in the need to expand existing or construct new wastewater treatment capacity. Operation would generate solid waste and hazardous waste from domestic trash at stations and maintenance facilities and waste generated from maintenance facility operation. Permanent generation of solid and hazardous waste would not result in impacts because implementation of a hazardous materials and waste management plan would minimize waste generation, and waste generation would not exceed available disposal capacity.

During construction, energy would be consumed to transport construction materials and to support major staging areas, field offices, and security lighting. Operation and maintenance of construction equipment during the construction period would also consume energy resources (fossil fuels). The energy consumption would range from 22,745 billion Btu to 29,290 billion Btu with payback periods for energy consumed during construction ranging from about 6.4 to 9.8 years. Energy use during construction would be temporary.

Operations of the project alternatives would decrease automobile VMT and reduce energy consumption by automobiles, resulting in an overall reduction in energy use for intercity and commuter travel. Due to the similarity in lengths of the project alternatives, impacts from energy use during operations would be the same for all project alternatives. The net change in energy use associated with the project alternatives would be an energy savings of 6,335,230 MMBtu/year in 2040 under the medium ridership scenario and 6,709,070 MMBtu/year in 2040 under the high ridership scenario.

3.6.9 CEQA Significance Conclusions

As described in Section 3.1.6.4, this section evaluates the impact of project actions under CEQA against thresholds to determine whether a project action would result in no impact, a less than significant impact, or a significant impact. Table 3.6-23 identifies the CEQA significance determinations for each impact discussed in Section 3.6.6, Environmental Consequences. A summary of the significant impacts, mitigation measures, and factors supporting the significance conclusion after mitigation follows the table.

Table 3.6-23 CEQA Significance Conclusions and Mitigation Measures for Public Utilities and Energy

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measures	CEQA Level of Significance after Mitigation
Public Utilities			
Impact PUE#1: Planned and Accidental Temporary Interruption of Utility Service	Less than significant for all alternatives: Through effective coordination and notification activities, project features (e.g., PUE-IAMF#3 and PUE-IAMF#4), will minimize potential effects on public utilities. The planned temporary reconstruction or relocation of major linear non-fixed facilities during project construction will be conducted in accordance with the construction safety management plan and safety and security management plan for the project (SS-IAMF#2).	No mitigation measures are required.	N/A
Impact PUE#2: Temporary Impacts from Water Use	Less than significant for all alternatives: Water conservation measures and use of nonpotable and recycled water for construction activities will reduce water use during construction. There is sufficient water supply available to serve project construction and reasonably foreseeable future development in normal, dry, and multiple dry years.	No mitigation measures are required.	N/A
Impact PUE#3: Reduced Access to Existing Utilities in the HSR Right-of-Way	Less than significant for all alternatives: Implementation of standard engineering and utility access practices for utilities remaining within the right-of-way and implementation of casing and maintenance access requirements for utilities remaining within the right-of-way would allow for the continued access to utilities for repair and maintenance while maintaining HSR operations. The project would not result in lengthy or harmful interruption of utility services due to restricted access.	No mitigation measures are required.	N/A

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measures	CEQA Level of Significance after Mitigation
Impact PUE#4: Permanent Conflicts with Existing Major Utilities Requiring Relocation	Significant for Alternative 1: Construction of Alternative 1 would displace wastewater treatment capacity at the percolation ponds operated by the SCRWA WWTP. 51 acres of existing percolation ponds would be displaced by construction of Alternative 1, resulting in a reduction in the facility's wastewater treatment capacity. Restoration of the reduced treatment capacity would require mitigation.	PUE-MM#1: Replace Percolation Ponds at SCRWA WWTP	Less than Significant
	Significant for Alternative 2: Construction of Alternative 2 would displace wastewater treatment capacity at the percolation ponds operated by the SCRWA WWTP. 51 acres of existing percolation ponds would be displaced by construction of Alternative 2, resulting in a reduction in the facility's wastewater treatment capacity, which could lead to a lengthy and harmful interruption of treatment service. Restoration of the reduced treatment capacity would require mitigation.	PUE-MM#1: Replace Percolation Ponds at SCRWA WWTP	Less than Significant
	Less than significant for Alternative 3 and Alternative 4: Alternatives 3 and 4 would not displace wastewater treatment capacity.	No mitigation measures are required.	N/A
Impact PUE#5: Temporary Impacts from Construction of New Utility Infrastructure	Less than significant for all alternatives: Relocation and construction of new and expanded water, wastewater treatment, stormwater drainage, electric power, natural gas, and telecommunications facilities for the project would not cause significant environmental effects.	No mitigation measures are required.	N/A
Impact PUE#6: Temporary Impacts from Stormwater and Wastewater Generation	Less than significant for all alternatives: The contractor would construct new stormwater management structures in accordance with the SWPPP and stormwater management and treatment plan. Project features, such as implementing BMPs and a SWPPP, as well as complying with local jurisdiction municipal separate storm sewer system permit requirements and RWQCB requirements applicable to regional WWTPs, will minimize impacts from stormwater and wastewater generation.	No mitigation measures are required.	N/A

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measures	CEQA Level of Significance after Mitigation
Impact PUE#7: Temporary Generation of Solid Waste and Hazardous Waste	Less than significant for all alternatives: Waste generation would not exceed the capacity of existing facilities in the RSA and impacts would be avoided through safe handling and disposal procedures and through compliance with existing regulations. Solid waste landfills within the RSA have sufficient permitted capacity for disposal of solid waste that would be generated during construction of the project alternatives; solid and hazardous waste management for the project alternatives would comply with federal, state, and local requirements related to solid and hazardous waste.	No mitigation measures are required.	N/A
Impact PUE#8: Continuous Permanent Impacts from Water Use	Less than significant for all alternatives: There is sufficient water supply available to serve project operation and reasonably foreseeable future development in normal, dry, and multiple dry years.	No mitigation measures are required.	N/A
Impact PUE#9: Continuous Permanent Impacts from Wastewater Generation	Less than significant for all alternatives: Wastewater generated at stations and maintenance facilities would be discharged to the sewer system and would not exceed available treatment capacities of local WWTPs. The construction of new wastewater infrastructure or the expansion of existing facilities would not be required, and the wastewater generated by the Project would not exceed RWQCB wastewater treatment requirements.	No mitigation measures are required.	N/A
Impact PUE#10: Permanent Impacts on Storm Drainage Facilities	Less than significant for all alternatives: The project would not require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.	No mitigation measures are required.	N/A

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measures	CEQA Level of Significance after Mitigation
Impact PUE#11: Continuous Permanent Generation of Solid Waste and Hazardous Waste	Less than significant for all alternatives: Waste generation during operations would not exceed the capacity of permitted solid and hazardous waste landfills and would be disposed of in a manner consistent with applicable regulations. Solid waste landfills within the RSA have sufficient permitted capacity for disposal of solid waste that would be generated during operation of the project alternatives; solid and hazardous waste management for the project alternatives would comply with federal, state, and local requirements related to solid and hazardous waste.	No mitigation measures are required.	N/A
Energy			
Impact PUE#12: Temporary Consumption of Energy during Construction	Less than significant for all alternatives: Energy consumption would not place a substantial demand on regional energy supply, require construction of substantial additional electric generating capacity, or substantially increase peak- or base-period electricity demand.	No mitigation measures are required.	N/A
Impact PUE#13: Continuous Permanent Impacts from Energy Consumption during Operations	Less than significant impact for all alternatives: Operation of the project would result in a net decrease in transportation energy use.	No mitigation measures are required.	N/A

BMP = best management practice
HSR = high-speed rail
N/A = not applicable
RCRA = Resource Conservation and Recovery Act
RSA = Resource Study Area
RWQCB = Regional Water Quality Control Board
SCRWA = South County Regional Wastewater Authority
SWPPP = stormwater pollution prevention plan
WWTP = wastewater treatment plant

3.7 Biological and Aquatic Resources

Since publication of the Draft Environmental Impact Report (EIR)/Environmental Impact Statement (EIS), the following substantive changes have been made to this section:

- Section 3.7.1.1, Definition of Terminology, was updated to clarify the aquatic resources regulated by the U.S. Army Corps of Engineers (USACE) and the California Department of Fish and Wildlife (CDFW) and state that confirmation of these resources would be obtained through the regulatory authorization process.
- Footnotes were added to Section 3.7.2.1, Federal, regarding FRA's Environmental Procedures and the updated Council on Environmental Quality (CEQ) regulations issued after release of the Draft EIR/EIS.
- A discussion of the recent California Migratory Bird Protection Act and associated Attorney General's advisory was added to Section 3.7.2.2, State.
- The status of formal consultations with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) was updated in Section 3.7.4, Consultation with Regulatory Agencies for Federal Endangered Species Act Compliance, and Section 3.7.11, Federal Endangered Species Act Findings.
- "Groundwater depletion" has been changed to "groundwater reduction" throughout this section.
- References were added to the list of major Wildlife Movement references in Section 3.7.5.3, Methods for Impact Analysis.
- Table 3.7-3 was updated to correct the county of occurrence of three soil associations.
- Reference to USACE Regulatory Guidance Letter 16-01 was corrected in text.
- The list of wildlife corridors in the Santa Clara Valley was clarified in the Wildlife Movement subsection of Section 3.7.6.2, Biological Conditions.
- A subheading was added to Section 3.7.6.2 for Waters of the State to distinguish those aquatic resources from Other Waters of the U.S.
- Clarifications and corrections were made to conservation areas and areas affected by the project, including new Figure 3.7-4 and updates to Table 3.7-11, Table 3.7-22, Impact BIO#51, and Section 3.7.9.7, Conservation Areas. Footnotes were added to Tables 3.7-11 and 3.7-22 to correct the name of Bloomfield conservation area, to explain the separate listing in the Final EIR/EIS of properties referred to collectively as the "Soap Lake Properties" in the Draft EIR/EIS, and to state that Tulare Meadows was recently added as conserved lands by the Santa Clara Valley Open Space Authority (SCVOSA); these changes resulted in changes to text that referred to the content of the tables.
- Changes were made to clarify the definitions related to the Grasslands Ecological Area (GEA) and associated protected areas.
- Analysis about the Diridon design variant (DDV) and tunnel design variant (TDV), which was included in Section 3.20 in the Draft EIR/EIS, was incorporated throughout this section in Impacts BIO#1 through BIO#30, BIO#33 through BIO#35, BIO#37, BIO#38, BIO#44, and BIO-MM#80; Section 3.7.7.2, Special-Status Species; Table 3.7-26; Section 3.7.9.2, Non-Special-Status Wildlife; and Section 3.7.10, CEQA Significance Conclusions.
- "Tunneling" has been changed to "tunnel construction" in several places throughout this section.
- Clarifications were made regarding mitigation for protected trees. The root depth of oaks and depth of shallow water table were updated in Impact BIO#1. BIO-MM#9 was clarified to note that oak roots may reach depths of up to 100 feet and thus changes to groundwater to that

depth will be considered as the area of potential effects on oaks and that plans for supplemental water will also consider best practices related to supplemental water near oak trees. BIO-MM#9 was also updated to require inventory and monitoring out to 1.1 miles from the tunnel alignment for the groundwater resource study area (RSA).

- Impact BIO#12 was updated to clarify that additional mitigation measures will be required to avoid take of blunt-nosed leopard lizard.
- Impact BIO#20 was updated to state that mitigation measures to address the loss of raptor nests and avoid take of fully protected species are identified in Section 3.7.10.
- Impact BIO#37 was revised to clarify terminology between aquatic resources considered jurisdictional under Section 404 of the Clean Water Act (CWA) and waters of the U.S. and of the state. The title of Table 3.7-18 was updated to reflect this terminology change.
- The discussion of aquatic resources regulated under Cal. Fish and Game Code Section 1600 et seq. under Impact BIO#38 was revised.
- Clarifications and additions regarding design, monitoring, and adaptive management of wildlife crossings were added. This resulted in updates to Impact BIO#43, Section 3.7.5, Methods for Evaluating Impacts; Section 3.7.9.6, Wildlife Movement; and Table 3.7-23 and the addition of new BIO-MM#77b. Under Impact BIO#44, the Draft EIR/EIS Species subsection was retitled Bird Species, and the text was revised to focus on bird species. The CEQA Conclusion subsection was updated to provide further explanation of the significance conclusion.
- Under the CEQA Conclusion subsection of Impact BIO#47, the discussion of lighting impacts was updated.
- The discussion of aerial species under Impact BIO#48 was updated. A source for condor flight tracking data was changed from CDFW to U.S. Geological Survey (USGS). The CEQA Conclusion subsection was updated to provide further explanation of the significance conclusion.
- Impact BIO#53 was updated to clarify that no conflict with the *Santa Clara Valley Habitat Plan* (SCVHP) (County of Santa Clara et al. 2012) was identified.
- Table 3.7-23 under Impact BIO#55 was revised to remove the statement that, under Alternative 4, the Fisher Creek culvert would not be modified.
- BIO-MM#3 was revised in response to comments from the NMFS on the biological assessment (BA).
- BIO-MM#7 was updated to state the project biologist will conduct protocol-level surveys for special-status plant species and special-status plant communities within each work area prior to any ground-disturbing activity and to specify a 50-foot buffer around special-status plant species occurrences, where feasible.
- BIO-MM#8, BIO-MM#55, BIO-MM#58, BIO-MM#63, BIO-MM#76, BIO-MM#81, and BIO-MM#85 were revised in response to public comments on the Draft EIR/EIS.
- The title of BIO-MM#10 was updated to more accurately reflect the intent of the mitigation measure. The description of the location of mitigation and the elements to be included in the habitat mitigation plan (HMP) were updated.
- BIO-MM#23 was updated to state the no-work buffer will provide at least 50 feet of clearance around Crotch bumble bee nest entrances.
- BIO-MM#26, including the title, was updated for general consistency with measure CM-FISH-4 in the NMFS biological opinion.
- BIO-MM#27a and BIO-MM#27b were added in response to NMFS comments and for consistency with measures AMM-FISH-1 and AMM-FISH-2, respectively, in the NMFS

biological opinion. BIO-MM#27c was updated for consistency with measure AMM-FISH-3 in the NMFS biological opinion.

- BIO-MM#28 was updated to be generally consistent with measure CM-FISH-1 in the NMFS biological opinion.
- Survey methods were added to BIO-MM#34.
- A reference to the California Endangered Species Act (CESA) was removed from BIO-MM#40.
- BIO-MM#43 was modified to note that surveys must be conducted no more than 10 days prior to construction and that the Project Biologist will monitor the nests for disturbance. BIO-MM#43 was also clarified to note that a no-work buffer of 75 feet may be increased if required by the Project Biologist to ensure that the nest is not disturbed.
- BIO-MM#52 was modified to clarify that surveys for nonlisted (and listed) raptors are required and that buffers of 500 feet for nonlisted raptors and 0.5 mile for listed or fully protected raptors are required.
- BIO-MM#60 was updated to clarify that artificial escape dens will be used to provide cover to San Joaquin kit fox during construction outside of work areas and that such dens will be removed once construction is complete.
- BIO-MM#62 was updated to specify that protocol-level trapping surveys will conform to the USFWS *Survey Protocol for Determining Presence of San Joaquin Kangaroo Rats* (USFWS 2013b) and that if Fresno kangaroo rat is confirmed present in the work area, all project activities in the work area will cease.
- BIO-MM#63 was revised for consistency with other measures for listed species mitigation.
- BIO-MM#66 was updated to state that the Project Biologist will establish a 50-foot no-work buffer around each woodrat stick house using environmentally sensitive area (ESA) fencing.
- BIO-MM#68 and BIO-MM#69 were updated to state that the relocation plan will be provided to CDFW for review and input and that, if a relocation plan is necessary, it will be developed in consultation with CDFW and/or other experts as necessary.
- BIO-MM#72 was updated to state that mitigation nearest the location of impact will be prioritized, as feasible, unless the conservation value will be greatest in another location.
- BIO-MM#75 was updated to include an oak/protected tree mitigation plan, including a 6:1 ratio for native oak trees and a 10-year monitoring and management period, and to state that ESA fencing will be installed within the root protection zone.
- BIO-MM#77a was updated to further define the specific guidelines and design features for wildlife crossings to facilitate their use by wildlife and to state that the California High-Speed Rail Authority (Authority) will work with agencies and wildlife movement stakeholders to validate and optimize wildlife crossings and will plan and prioritize species and wetland and natural community mitigation land acquisition at or near wildlife crossing entrances. The Authority will prepare and submit for review a Wildlife Crossing Design, Inspection, and Maintenance Plan, developed in coordination with wildlife agencies and local wildlife movement stakeholders.
- BIO-MM#78 was revised to limit the length of wildlife crossings in western Pacheco Pass to no more than 120 feet.
- BIO-MM#79 was modified to prioritize the protection of open space corridors between wildlife undercrossings and the nearest conserved open space, floodplain, passive recreation, or open agricultural properties to maintain and facilitate the permanent functionality of wildlife crossings.

- BIO-MM#80 was revised to require additional noise barriers to minimize impacts of noise on wildlife.
- Additional mitigation was added (new BIO-MM#84a) addressing avoidance and minimization of impacts on conservation areas.
- BIO-MM#84b was modified to require the Authority to provide additional funding to offset staff time associated with identifying and protecting replacement sites and to add San Benito Land Trust as an example of an affected organization that will be compensated for any incurred penalties resulting from the permanent loss of a conservation area and to offset staff time, as noted above.
- Impact and significance summary Tables 3.7-26 and 3.7-27 were updated to reflect changes identified above.
- Section 3.7.9.1, Special-Status Species, was updated to include BIO-MM#27a, BIO-MM#27b, and BIO-MM#27c in the Special-Status Fish subsection.
- Section 3.7.9.8, Habitat Conservation Plans, was updated to include reference to BIO-MM#77a, BIO-MM#84a, and BIO-MM#84b.
- A statement about special-status plants (a typographical error) was removed in three places in Section 3.7.10. BIO-MM#27a, BIO-MM#27b, and BIO-MM#27c were added under the Impact BIO#6 subsection, BIO-MM#77b was added under the Impact BIO#43 subsection, and BIO-MM#84a was added under the Impact BIO#51 subsection in Section 3.7.10.
- BIO-MM#P1 was added to clarify compensatory mitigation for impacts on the Grasslands Ecological Area.
- Revisions to Section 3.7.1, Introduction; Section 3.7.4.1, Consultation History with the U.S. Fish and Wildlife Service: Wildlife; Section 3.7.4.2, Consultation History with the National Marine Fisheries Service: Fish; Section 3.7.5.3; Section 3.7.6.2; Section 3.7.7.2; Section 3.7.7.7, Wildlife Movement; Section 3.7.8, Mitigation Measures; Section 3.7.9, Impact Summary for NEPA Comparison of Alternatives; Section 3.7.9.1; Section 3.7.9.6; Section 3.7.9.8; and Section 3.7.10 were made to incorporate changes included in the *San Jose to Merced Project Section: Revised Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement, Biological Resources Analysis* (Revised/Supplemental Draft EIR/EIS) and in response to public comments on the Revised/Supplemental Draft EIR/EIS. Revised/Supplemental Draft EIR/EIS Appendix 3.7-D, Supplemental Species Habitat Model Descriptions; Appendix 3.7-E, Supplemental Noise Analysis on Terrestrial Wildlife Species; and Appendix 3.7-F, Supplemental Artificial Light Analysis on Terrestrial Wildlife Species (located in Volume 2, Technical Appendices) were added to this Final EIR/EIS.
- Section 3.7.11, Federal Endangered Species Act Findings, and Table 3.7-28 were updated to reflect the continued consultation with USFWS and NMFS and the status of the biological opinions.
- Where appropriate, the verb “would,” when used specifically to describe impact avoidance and minimization features (IAMFs) or mitigation measures, as well as their directly related activities, was changed to “will,” indicating their integration into project design.

3.7.1 Introduction

This section describes biological and aquatic resources in the RSA, describes the sources and methods used to characterize these resources, evaluates the potential for construction and operation of the San Jose to Central Valley Wye Project Extent (project or project extent) to affect these resources, and proposes mitigation measures to reduce those impacts.

The *San Jose to Merced Project Section: Biological and Aquatic Resources Technical Report* (Biological and Aquatic Resources Technical Report) (Authority 2020a) and *San Jose to Merced*

Project Section: Aquatic Resources Delineation Report (Authority 2019a) provide additional technical details on biological and aquatic resources and serve as sources for this analysis. Supporting information pertaining to biological and aquatic resources is provided in the following technical appendices in Volume 2 of this Final EIR/EIS:

- Appendix 2-D, Applicable Design Standards, provides the list of design standards for the project alternatives that have bearing on biological and aquatic resources.
- Appendix 2-J, Regional and Local Plans and Policies, provides a list by resource of all applicable regional or local plans and policies.
- Appendix 3.7-A, Special-Status Species Potentially Affected by the Project, provides a list of special-status species with the potential to be affected and the rationale for their inclusion or dismissal.
- Appendix 3.7-B, Scientific Nomenclature, provides a list of the common and scientific names of all species mentioned in the text.
- Appendix 3.7-C, HSR Guideway Enclosure Grasslands Ecological Area, provides an overview of the design analysis for an enclosure.
- Appendix 3.7-D, Supplemental Species Habitat Model Descriptions, provides mountain lion and monarch butterfly habitat model descriptions that were included in the Revised/Supplemental Draft EIR/EIS.
- Appendix 3.7-E, Supplemental Noise Analysis on Terrestrial Wildlife Species, provides the noise analysis included in the Revised/Supplemental Draft EIR/EIS.
- Appendix 3.7-F, Supplemental Artificial Light Analysis on Terrestrial Wildlife Species, provides the lighting analysis included in the Revised/Supplemental Draft EIR/EIS.

In addition to the analysis presented in this section and the relevant appendices, five other Final EIR/EIS sections provide analyses of topics that can also be relevant to biological and aquatic resources:

- Section 3.4, Noise and Vibration, discusses noise and vibration that would result from construction and operations of the project. Potential impacts of noise and vibration on wildlife are based on information provided in the *High-Speed Ground Transportation Noise and Vibration Impact Assessment Manual* (FRA 2012).
- Section 3.8, Hydrology and Water Resources, discusses existing surface water hydrology, water quality, groundwater, and floodplains, and identifies potential impacts on these resources for each project alternative.
- Section 3.14, Agricultural Farmland, discusses the range of impacts on agricultural lands that may overlap with the biological resources discussed and evaluated in this section.
- Section 3.18, Regional Growth, includes a discussion of growth-inducing impacts.
- Section 3.19, Cumulative Impacts, describes the cumulative impacts of this and other past, present, and reasonably foreseeable future projects.

3.7.1.1 Definition of Terminology

Land Cover Types

For the purposes of this section, a *land cover type* is the dominant character of the land surface discernible from aerial photographs, as determined by vegetation, water, or human uses. Land cover types are the most widely used units in analyzing ecosystem function, habitat diversity, natural communities, aquatic resources, and species habitat, and provide the foundation for analyzing impacts on biological resources (e.g., special-status plant communities, aquatic resources). More information on land cover mapping and interpretation is provided in Section 3.7.5.

Several terms related to land cover types and vegetation are used in this analysis. The primary reference for describing vegetation in California is the *Manual of California Vegetation* (Sawyer et al. 2009; CNPS 2017), a prominent scientific publication distributed by the California Native Plant Society (CNPS) in collaboration with the CDFW that has been adopted as the standard for vegetation classification and description by state and federal agencies. Definitions of *Manual of California Vegetation* terms used or referenced in this report are:

- **Alliance**—A classification unit of vegetation, containing one or more associations and defined by one or more diagnostic species, often of high cover, in the uppermost layer or the layer with the highest canopy cover.
- **Association**—A vegetation classification unit defined by a diagnostic species, a characteristic range of species composition, physiognomy, and distinctive habitat conditions.
- **Community**—A group of organisms living together and linked together by their effects on one another and their responses to the environment they share.
- **Habitat**—The biological and environmental conditions associated with a vegetation type, including "the resources and conditions present in an area that enable occupancy—including survival and reproduction—by a given organism" (Hall et al. 1997).
- **Natural community**—See *plant community*.
- **Plant community**—A group of plant species living together and linked together by their effects on one another and their responses to the environment they share (CNPS 2017). Synonymous with *natural community* for the purposes of this analysis.
- **Vegetation type**—A classification unit of vegetation at any level in the National Vegetation Classification hierarchy (e.g., alliance, association), or a unit used when vegetation has not been classified formally to a specific level. A vegetation type is typically defined on the basis of shared floristic or physiognomic characteristics. It is comparable to a taxon in plant classification.

Special-Status Species

For the purposes of this analysis, *special-status species* are defined as follows:

- Plants or wildlife listed or proposed for listing as threatened or endangered under the federal Endangered Species Act (FESA) (16 United States Code [U.S.C.] § 1531 et seq.).
- Plants or wildlife listed or candidates for listing as threatened or endangered under the CESA (California [Cal.] Fish and Game Code §§ 2050–2085).
- Plants listed as rare under the California Native Plant Protection Act (NPPA) (Cal. Fish and Game Code §§ 1900–1913).
- Plants assigned to California Rare Plant Ranks (CRPR) 1A, 1B, 2A, 2B, and 3 (CNPS 2018):
  - 1A—Plants presumed extirpated in California and either rare or extinct elsewhere.
  - 1B—Plants rare, threatened, or endangered in California and elsewhere.
  - 2A—Plants presumed extirpated in California but common elsewhere.
  - 2B—Plants rare, threatened, or endangered in California but more common elsewhere.
  - 3—Plants about which more information is needed.
- Wildlife species, subspecies, or distinct populations designated as California species of special concern by the CDFW.
- Wildlife designated as Fully Protected (Cal. Fish and Game Code §§ 3511 [birds], 4700 [mammals], 5515 [fish], and 5050 [reptiles and amphibians]).
- Plants or wildlife determined to meet the definitions of rare or endangered under Sections 15380 and 15125 of the California Environmental Quality Act (CEQA) Guidelines.

Although not defined as special-status species per se, *critical habitat* and *essential fish habitat* (EFH) are also addressed in this section since they refer to geographic areas or features that the USFWS or NMFS have designated as important for the conservation of federally listed species or federally managed fisheries, respectively. These designations are further described in the following subsections.

Critical Habitat

Critical habitat is a specific, formally designated geographic area(s) that contains *physical or biological features* (see definition below) essential for the conservation of a threatened or endangered species and that may require special management and protection.

Physical or biological features (PBF) refer to those physical and biological features that are essential to a listed species' conservation within an area formally designated as critical habitat for that species (50 Code of Federal Regulations [C.F.R.] § 424.12).

Primary constituent elements (PCE) was a term introduced in the critical habitat designation regulations (50 C.F.R. § 424.12) to describe aspects of PBFs that are referenced in the statutory definition of critical habitat. In 2016, USFWS removed the PCE term and returned to the statutory term PBFs (81 Fed. Reg. 7214). The shift in terminology, however, does not change the approach used in conducting an analysis of impacts on critical habitat, which is the same regardless of whether the original designation identified PCEs, PBFs, or both. Although the critical habitat designations as published for the species assessed herein identified PCEs, this report uses the term PBF in place of the term PCE, consistent with the 2016 revised regulation.

Essential Fish Habitat

EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." For the purposes of interpreting the definition of EFH, *waters* include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; *substrate* includes sediment, hard bottom, structures underlying the waters, and associated biological communities; *necessary* means habitat required to support a sustainable fishery and a healthy ecosystem; and *spawning, breeding, feeding, or growth to maturity* covers a species' full life cycle. The following characteristics of EFH must be adequate for spawning, rearing, and migration:

- Substrate composition
- Water quality
- Water quantity, depth, and velocity
- Channel gradient and stability
- Food
- Cover and habitat complexity
- Space
- Access and passage
- Habitat connectivity

The Magnuson-Stevens Fisheries Conservation and Management Act (Magnuson-Stevens Act) requires all federal agencies to consult with the NMFS on all actions or proposed actions permitted, funded, or undertaken by the federal agency that may adversely affect EFH. *Adversely affect* means any effect that reduces the quality or quantity of EFH. Adverse effects may include direct (e.g., contamination, physical disruption), indirect (e.g., loss of prey), site-specific, or habitat-wide effects, including individual, cumulative, or synergistic consequences of actions (PFMC 2014).

Non-Special-Status Wildlife

For the purposes of this analysis, *non-special-status wildlife* is an umbrella term for wildlife species or species groups that do not meet the definition of a special-status species as defined earlier in this section, but that may still be affected by construction and operations of the project, including native birds protected under the Migratory Bird Treaty Act (MBTA) and Cal. Fish and

Game Code Section 3503, as well as species groups of regional or international conservation concern (e.g., waterfowl and shorebirds, roosting bats).

Special-Status Plant Communities

Special-status plant communities are plant communities that are of limited distribution statewide or within a county or region, and that are often vulnerable to the environmental effects of projects (CDFG 2009). The CDFW maintains a *California Sensitive Natural Community List* (CDFW Sensitive Community List) (CDFW 2018a). This list is based on the *Manual of California Vegetation* (Sawyer et al. 2009) and assigns global and state rarity rankings based on NatureServe's Heritage Program methodology (Master et al. 2012). Communities with state ranks of S1–S3 are considered "highly imperiled," and effects on these communities are typically considered significant by the CDFW. State ranks S1–S3 are defined as follows:

- S1: Fewer than 6 viable occurrences or up to 1,280 acres statewide
- S2: 6–20 viable occurrences or 1,280–6,400 acres statewide
- S3: 21–100 viable occurrences or 6,400–32,000 acres statewide

The rarity ranking is sometimes modified by an additional threat ranking:

- 0.1: Very threatened
- 0.2: Threatened
- 0.3: No current threat known

Aquatic Resources

Aquatic resources within the aquatic resources study area are wetlands and nonwetland waters that are considered jurisdictional under Section 404 of the federal Clean Water Act (CWA), collectively called waters of the U.S., waters of the state regulated under the Porter-Cologne Water Quality Control Act, and aquatic and other related resources regulated under Cal. Fish and Game Code Section 1600 et seq. The USACE regulates waters of the U.S., the State Water Resources Control Board (SWRCB) regulates waters of the state, and CDFW regulates the bed, channel, and banks of rivers, streams, and lakes. The definitions of the regulatory categories for aquatic resources are presented in this section. Confirmation of these resources as jurisdictional by USACE, or regulated by SWRCB or CDFW, would be obtained through the regulatory authorization process. The project extent crosses areas under the jurisdiction of two USACE districts: the Sacramento District and the San Francisco District.

Waters of the U.S., including Wetlands (Clean Water Act § 404)

The federal CWA (33 U.S.C. § 1251 et seq.) defines *waters of the U.S.* as follows:

> *(1) all waters that are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters that are subject to the ebb and flow of the tide; (2) all interstate waters including interstate wetlands; (3) all other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce; (4) all impoundments of waters otherwise defined as waters of the U.S.; (5) tributaries to the foregoing types of waters; and (6) wetlands adjacent to the foregoing waters (33 C.F.R. § 328.3(a)).*

Wetlands are a sub-classification of waters of the U.S. The term *nonwetland waters* is used to describe waters of the U.S. exclusive of wetlands.

According to the *Corps of Engineers Wetlands Delineation Manual* (USACE Delineation Manual) (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* (Version 2.0) (USACE Arid West Supplement) (USACE 2008a), three criteria must be satisfied to classify an area as a wetland. These criteria are: (1) a predominance of plant life that is adapted to life in wet conditions (hydrophytic vegetation); (2) soils that saturate, flood, or pond long enough during the growing season to

develop anaerobic conditions in the upper part (hydric soils); and (3) permanent or periodic inundation or soil saturation, at least seasonally (wetland hydrology).

Waters of the State (Porter-Cologne Water Quality Control Act)

Waters of the state are broadly defined by the Porter-Cologne Water Quality Control Act (Cal. Water Code § 13050(e)) to mean any surface water or groundwater, including saline waters, within the boundaries of the state. Under this definition, isolated wetlands that may not be subject to regulation under federal law are considered waters of the state and regulated accordingly.

On April 2, 2019, the SWRCB adopted its proposed State Wetland Definition and Procedures for Discharges of Dredge or Fill Material to Waters of the State (Procedures). Among other provisions, the Procedures define certain *wetlands* as *waters of the state* under the Porter-Cologne Water Quality Control Act. The Procedures also provide a jurisdictional framework for the determination of aquatic features as wetlands. Such wetland features under the Procedures are identified and analyzed as *aquatic resources* throughout this document. Compliance with the SWRCB Procedures for the project would be achieved through adherence to the provisions set forth in a Memorandum of Understanding between the SWRCB and the Authority dated January 19, 2017, and amended March 11, 2019.

California Fish and Game Code Section 1600 et seq.

Pursuant to Cal. Fish and Game Code Section 1600 et seq., CDFW regulates activities of an applicant's project that would substantially alter the flow, bed, channel, or bank of rivers, streams or lakes and substantially adversely affect fish or wildlife resources. Under Cal. Fish and Game Code Section 1602, the scope of CDFW's jurisdiction extends to rivers, streams, and lakes. The state's jurisdiction generally includes the streambed/lakebed to tops of bank. Although not specifically defined in Cal. Fish and Game Code Section 1602, jurisdiction in some instances may include adjacent riparian vegetation. A riparian area consists of the transitional habitat between terrestrial and aquatic ecosystems, specifically the vegetated areas between a riverine feature and the outer drip line of the adjacent vegetation. In practice, CDFW has extended its authority to the top of a bank of a stream, the bank of a lake, or outer edge of the riparian vegetation, whichever is wider. The term *stream* is commonly understood as a watercourse having a source and terminus, banks and channel, through which waters flow, at least periodically. A *streambed* under Section 1602 includes the channel of a watercourse, which is generally defined to include the depression between the banks worn by the regular and usual flow of the water.

Protected Trees

Protected trees are trees that have special significance and are afforded protection by, and specifically identified in, county and city ordinances, codes, or general plans. Cities and counties traversed by the project that may have tree protection regulations include the Counties of Santa Clara, San Benito, and Merced as well as the Cities of Santa Clara, San Jose, Morgan Hill, and Gilroy. The types of trees and specific physical characteristics required to meet the local tree definitions are further addressed in Volume 2, Appendix 2-J.

Wildlife Movement

The movement of wildlife between patches of suitable habitat is an important ecological process. Species make daily movements to forage, avoid predators, and find refugia. Longer distance movement is often associated with breeding or juvenile dispersal. Movement distances and patterns are affected by factors such as sex (males tend to move greater distances, on average, than females), habitat distribution, prey density, and topography.

Wildlife movement facilitates genetic and demographic exchange, allows recolonization, contributes to maintenance of metapopulations, and minimizes the risk of inbreeding. Without functional movement between habitat areas, populations would be subject to increased risk of collapse and, in severe cases, extirpation.

The Authority prepared a Wildlife Corridor Assessment (WCA) (Appendix C of the Biological and Aquatic Resources Technical Report [Authority 2020a]) to address impacts on wildlife movement.

The impact analysis in this section is based on that document. Some important terms and concepts associated with the study of wildlife movement are presented in the following paragraphs.

- **Permeability**—The degree to which landscapes facilitate animal movement and other ecological flows, also known as *connectivity* (FHWA 2011). High levels of landscape permeability occur when the area between habitat patches contains few barriers to movement. Reduced permeability occurs when the area between habitat patches contains barriers to movement such as roads and urban development.
- **Wildlife corridors**—Landscape features that provide for the movement of wildlife between two or more habitat patches (Soulé and Gilpin 1991; Beier and Loe 1992). Wildlife corridors may be natural or artificial, but they often provide the shortest, most direct linkage between two patches of suitable habitat for a stated target species.

  A natural wildlife movement corridor may be a riparian area or narrow valley that wildlife uses to travel between two larger patches of suitable habitat such as forest or grassland. Artificial wildlife corridors are routes through developed regions that animals use to navigate between suitable habitat patches. Such corridors may include a combination of roads, riparian areas, culverts, bridges, underpasses, and overpasses.

  Regional wildlife corridors identified in statewide or regional reports (Spencer et al. 2010; Penrod et al. 2013) or identified by the wildlife agencies (USFWS or CDFW) as important for the preservation of connectivity for federally or state-listed species have been mapped in the vicinity of the project, and some intersect the high-speed rail (HSR) alignment. Local movement corridors are less well understood; however, occurrence data, roadkill locations, and camera trap data provide an indication of wildlife movement patterns in the vicinity of the rail alignment. This analysis combines the modeling results for post-project permeability with evidence of local and regional wildlife movement to characterize the severity of the effect and to inform mitigation location and design.

Conservation Areas

Conservation areas are land parcels that are protected or managed specifically or that have been designated for the conservation of biological or aquatic resources. This report discusses three types of conservation areas: conservation easements, public lands (refuges and ecological reserves), and conservation and mitigation banks.

Conservation Easements

A *conservation easement* is a binding, legal agreement between a landowner and a land trust or government agency that limits uses of the land to protect its conservation values and achieve specific conservation objectives. A conservation easement allows landowners to continue to own and use their land. However, certain actions are prohibited, and the landowner agrees to conserve or restore habitat, open space, scenic, or other ecological resource values on the land covered by the easement.

Publicly Owned Lands

Public lands are owned and typically maintained by the government, including cities, counties, states, and the federal government. Public lands considered in this analysis comprise wildlife refuges and ecological reserves.

Conservation and Mitigation Banks

Conservation and *mitigation banks* are permanently protected lands that contain natural resource values. These lands are conserved and permanently managed for special-status species, wetlands or waters, or other natural resources. Conservation and mitigation banks function to offset impacts on natural resources that occurred elsewhere; for this reason, these banks are sometimes referred to as off-site mitigation. In exchange for permanently protecting the land and managing it for natural resources, the natural resource regulatory agencies (USFWS, USACE,

NMFS, or CDFW) approve a specified number of natural resource (habitat, species, or resource) credits that bank owners may sell.

Habitat Conservation Plans

Habitat conservation plans (HCP) are planning documents required as part of an application for an incidental take permit under Section 10 of the FESA; for the purposes of this analysis, an HCP is also defined in Appendix G to the CEQA Guidelines, as other approved local, regional, or state conservation plans. As defined in this document, HCPs also include natural community conservation plans (NCCP) prepared under California's Natural Community Conservation Planning Act (NCCPA), which identify measures necessary to conserve and manage natural biological diversity within the planning area while allowing compatible and appropriate economic development, growth, and other human uses. One adopted federal HCP and state NCCP overlaps with the project alternatives, the SCVHP (County of Santa Clara et al. 2012). In addition, two locally approved conservation plans overlap with the project alternatives, the *Santa Clara Valley Greenprint* (Greenprint) (SCVOSA 2014), and the *Coyote Valley Landscape Linkage* report (SCVOSA 2017).

3.7.2 Laws, Regulations, and Orders

This section presents federal and state laws, regulations, and orders applicable to biological and aquatic resources that could be affected by the project. The Authority would implement the overall HSR project, including the project, in compliance with all federal and state regulations. Regional and local laws, regulations, and orders considered in preparing this analysis are provided in Volume 2, Appendix 2-J.

3.7.2.1 Federal

Federal Railroad Administration, Procedures for Considering Environmental Impacts (64 *Fed. Reg.* 28545)

On May 26, 1999, the Federal Railroad Administration (FRA) released *Procedures for Considering Environmental Impacts*. These FRA procedures supplement the CEQ Regulations (40 C.F.R. Part 1500 et seq.) and describe FRA's process for assessing the environmental impacts of actions and legislation proposed by the agency as well as for preparation of associated documents (42 U.S.C. § 4321 et seq.).[1],[2] The FRA *Procedures for Considering Environmental Impacts* state that "the EIS should identify any significant changes likely to occur in the natural environment and in the developed environment. The EIS should also discuss the consideration given to design quality, art, and architecture in project planning and development as required by U.S. Department of Transportation Order 5610.4." These FRA procedures state that an EIS should consider possible impacts on ecological systems, wetlands, and endangered wildlife species.

Federal Endangered Species Act of 1973 (16 U.S.C. § 1531 et seq.)

The FESA and subsequent amendments provide guidance for conserving federally listed species and their habitat. Sections of the FESA applicable to the project are discussed in this section.

- Section 7 requires federal agencies to consult with the USFWS or NMFS, as appropriate, so that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of threatened or endangered fish, wildlife, or plant species, or result in the destruction or adverse modification of designated critical habitat for any such species. As part

[1] While this EIR/EIS was being prepared, FRA adopted new NEPA compliance regulations (23 C.F.R. 771). Those regulations only apply to actions initiated after November 28, 2018. See 23 C.F.R. 771.109(a)(4). Because this EIR/EIS was initiated prior to that date, it remains subject to FRA's Environmental Procedures rather than the Part 771 regulations.

[2] The Council on Environmental Quality issued new regulations on July 14, 2020, effective September 14, 2020, updating the NEPA implementing procedures at 40 C.F.R. Parts 1500-1508. However, this project initiated NEPA before the effective date and is not subject to the new regulations, relying on the 1978 regulations as they existed prior to September 14, 2020. All subsequent citations to Council on Environmental Quality regulations in this environmental document refer to the 1978 regulations, pursuant to 40 C.F.R. 1506.13 (2020) and the preamble at 85 Fed. Reg. 43340.

of the consultation, USFWS and NMFS would issue a biological opinion and an incidental take statement for wildlife species to exempt the Section 9 take prohibition.

- Section 9 and its implementing regulations prohibit the take of any fish or wildlife species listed under the FESA as endangered or threatened, unless otherwise authorized by federal regulations. The term *take* means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Take also includes the modification of a listed species' habitat. Section 9 and the implementing regulations prohibit a number of specified activities with respect to endangered and threatened plants.
- Section 10 provides a process by which nonfederal entities may obtain an incidental take permit from USFWS or NMFS for otherwise lawful activities that might incidentally result in take of endangered or threatened animal species, subject to specific conditions. The project is a federal agency project and therefore would not utilize Section 10; however, the project would affect areas covered by Section 10 HCPs (e.g., SCVHP).

Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. § 1801 et seq.)

The amended Magnuson-Stevens Act, also known as the Sustainable Fisheries Act (Public Law [PL] 104-297), requires that all federal agencies consult with NMFS on activities or proposed activities authorized, funded, or undertaken by that agency that may adversely affect EFH of commercially managed marine and anadromous fish species.

Clean Water Act (33 U.S.C. § 1251 et seq.)

The CWA serves as the primary federal law protecting the quality of the nation's surface waters, including wetlands. Sections of the CWA applicable to the project are further discussed in this section.

- Under Section 401, a federal agency may not issue a permit or license to conduct any activity that may result in any discharge into waters of the United States unless a state where the discharge would originate issues a Section 401 water quality certification verifying compliance with existing water quality requirements or waives the certification requirement.
- Under Section 402, all point-source discharges, including construction-related stormwater discharges to surface waters, are regulated through the National Pollutant Discharge Elimination System (NPDES) program. Project sponsors must obtain an NPDES permit from the SWRCB.
- Under Section 404, the USACE and U.S. Environmental Protection Agency regulate the discharge of dredged and fill materials into the waters of the U.S. Project sponsors must obtain a CWA Section 404 permit from the USACE for discharges of dredged or fill materials into waters of the U.S. (wetlands and other waters) under USACE jurisdiction.

U.S. Fish and Wildlife Coordination Act (16 U.S.C. §§ 661–666c)

The U.S. Fish and Wildlife Coordination Act applies to any federal project where any body of water is impounded, diverted, deepened, or otherwise modified. Project proponents are required to consult with the USFWS and appropriate state wildlife agency.

Migratory Bird Treaty Act (16 U.S.C. §§ 703–712; PL 108–447)

The MBTA of 1918 prohibits the take of the nest, eggs, birds, or any parts thereof (listed at 50 C.F.R. § 10.13, as modified by 75 Fed. Reg. 9281). The MBTA defines migratory birds broadly; all birds native to North America are considered migratory birds under the MBTA. The Migratory Bird Treaty Reform Act (16 U.S.C. § 703 et seq.; PL 108–447) amends the MBTA of 1918 to exclude nonnative birds or birds that have been introduced by humans to the U.S. or its territories from protection under the MBTA. The statute defines a native migratory bird as a species present in the U.S. and its territories as a result of natural biological or ecological processes.

Bald and Golden Eagle Protection Act (16 U.S.C. §§ 668–668(d), 50 C.F.R. § 22)

The Bald and Golden Eagle Protection Act (BGEPA) prohibits anyone from taking, possessing, or transporting bald eagle or golden eagle, or the parts, nests, or eggs of such birds without prior

authorization. *Take* is defined to include pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, and disturb. *Disturb* is further defined in 50 C.F.R. Section 22.3 as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." The BGEPA regulations authorize issuance of incidental take permits of bald and golden eagles under the following conditions: (1) the take is compatible with the preservation of the bald eagle and golden eagle, (2) it is necessary to protect an interest in a particular locality, (3) it is associated with but not the purpose of an otherwise lawful activity, and (4) it cannot be practicably avoided (50 C.F.R. § 22.26).

Protection of Wetlands (USEO 11990)

U.S. Presidential Executive Order (USEO) 11990 aims to avoid direct or indirect impacts on wetlands from federal or federally approved projects when a practicable alternative is available. If wetland impacts cannot be avoided, all practicable measures to minimize harm must be included.

Protection of Migratory Bird Populations (USEO 13186)

USEO 13186 directs each federal agency taking actions that have or may have an adverse impact on migratory bird populations to work with USFWS to develop a memorandum of understanding that will promote the conservation of migratory bird populations.

Invasive Species (USEO 13112)

USEO 13112 requires federal agencies to work to the extent practicable and permitted by law to prevent and control the introduction and spread of invasive plants and animals.

3.7.2.2 State

California Endangered Species Act (Cal. Fish and Game Code, §§ 2050–2085)

The CESA prohibits the take of any fish, wildlife, or plant species listed as endangered or threatened, or designated as candidates for listing, under CESA. *Take* under CESA means hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill. It does not include "the taking of habitat alone or the impacts of the taking.[3]" Compared to the FESA process, CESA contains a procedure for the CDFW to issue a Section 2081 incidental take permit authorizing the take of listed and candidate species incidental to an otherwise lawful activity, subject to specified conditions, including that the effects of the take are fully mitigated.

California Fish and Game Code

Fully Protected Species (Cal. Fish and Game Code, §§ 3511, 4700, 5050, and 5515)

The California Fish and Game Code designates 37 fully protected species and prohibits the take or possession at any time of such species with certain limited exceptions. Fully protected species are described in Cal. Fish and Game Code Sections 3511 (birds), 4700 (mammals), 5050 (reptiles and amphibians), and 5515 (fish). These protections state that "…no provision of this code or any other law shall be construed to authorize the issuance of permits or licenses to take any fully protected [bird], [mammal], [reptile or amphibian], [fish]."

Bird Protections (Cal. Fish and Game Code, §§ 3503, 3503.5, and 3513)

Cal. Fish and Game Code Section 3503 states that it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by code or any regulation made pursuant thereto. Section 3503.5 prohibits the take, possession, or needless destruction of any nests, eggs, or birds in the orders Falconiformes (New World vultures, hawks, eagles, ospreys, and falcons, among others) or Strigiformes (owls). In late 2018, the CDFW and California Attorney General published an advisory "Affirming California's Protections for Migratory

[3] Environmental Council of Sacramento v. City of Sacramento, 142 Cal. App. 4th 2018 (2006).

Birds," which clarified the California laws protecting birds. In 2019, the California legislature approved Assembly Bill 454, also known as the California Migratory Bird Protection Act. Assembly Bill 454 amended Section 3513 of the California Fish and Game Code relating to the take or possession of migratory birds. Section 3513 prohibits the take or possession of any migratory nongame bird or part thereof, as designated in the federal MBTA. To avoid violation of the take provisions, project-related disturbance at active nesting territories generally are required to be reduced or eliminated during the nesting cycle.

Lake and Streambed Alteration (Cal. Fish and Game Code, § 1600 et seq.)

Section 1600 et seq. of the Cal. Fish and Game Code requires notifying the CDFW prior to any project activity that might (1) substantially divert or obstruct the natural flow of any river, stream, or lake; (2) substantially change or use any material from the bed, channel, or bank of any river, stream, or lake; or (3) deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake. If after this notification CDFW determines that the activity may substantially adversely affect fish and wildlife resources, a Lake or Streambed Alteration Agreement would need to be obtained.

Under Cal. Fish and Game Code Section 1602, the CDFW takes jurisdiction over rivers, streams, and lakes. The state's jurisdiction generally includes the streambed/lakebed to tops of bank. The term *stream* is commonly understood as a watercourse having a source and terminus, banks and channel, through which waters flow, at least periodically. A *streambed* under Section 1602 includes the channel of a watercourse, which is generally defined to include the depression between the banks worn by the regular and usual flow of the water.

Natural Community Conservation Planning Act (Cal. Fish and Game Code, §§ 2800–2835)

In 1991, the NCCPA was enacted to encourage broad-based planning to provide for effective protection and conservation of the state's wildlife resources while continuing to allow appropriate development and growth. Pursuant to the NCCPA, local, state, and federal agencies are encouraged to prepare NCCPs to provide comprehensive management and conservation of multiple species and their habitats under a single plan, rather than through preparation of numerous individual plans on a project-by-project basis. The NCCPA is broader in its orientation and objectives than are FESA and CESA. To be approved by CDFW, an NCCP must provide for the conservation of species and protection and management of natural communities in perpetuity within the plan area. Conservation is defined by the NCCPA and the Cal. Fish and Game Code as actions that result in the delisting of state-listed species.

The 1991 NCCPA was replaced with a substantially revised and expanded NCCPA in 2002. The revised NCCPA established new standards and guidance on many facets of the program, including scientific information, public participation, biological goals, interim project review, and approval criteria. The new NCCPA took effect on January 1, 2003. To approve an NCCP under the new NCCPA, CDFW must make a series of findings.

- The plan must be consistent with the Planning Agreement.
- The plan must provide for the conservation and management of the covered species (conservation is defined to mean that the Plan must contribute to species recovery).
- The plan must protect habitat, natural communities, and species diversity on the landscape level.
- The plan must conserve the ecological integrity of large habitat blocks, ecosystem function, and biodiversity.
- The plan must support sustainable populations of covered species.
- The plan must provide a range of environmental gradients and habitat diversity to support shifting species distributions.
- The plan must sustain movement of species among reserves.

- Mitigation and conservation must be roughly proportional to impacts in timing and extent.
- Funding for conservation, monitoring, and adaptive management must be adequately assured.

The project alternatives overlap with one NCCP, the SCVHP, and the analysis within this document must evaluate whether there any conflicts between the SCVHP and the project alternatives.

California Native Plant Protection Act (Cal. Fish and Game Code, §§ 1900–1913)

The NPPA requires all state agencies to use their authority to carry out programs to conserve endangered and rare native plants. The NPPA gives the CDFW the power to designate native plants as "endangered" or "rare" and prohibits the take of such plants, with certain exceptions.

Porter-Cologne Water Quality Control Act (Cal. Water Code, § 13000 et seq.)

The Porter-Cologne Water Quality Control Act provides for implementation of the federal CWA by the SWRCB, including issuance of CWA Section 401 Certifications and Section 402 NPDES permits. Issuance of a Section 401 Certification requires documenting compliance with state water quality standards, including watershed plans, designated beneficial uses, and the total maximum daily load program.

The Porter-Cologne Water Quality Control Act also regulates discharges that could affect the quality of waters of the state and requires a waste discharge requirements form be obtained for discharges, including fill of wetlands, that are not otherwise authorized by Section 404 or Section 402 of the federal CWA. Application for waste discharge requirements requires filing a report of waste discharge.

On April 2, 2019, the SWRCB adopted its proposed State Wetland Definition and Procedures for Discharges of Dredge or Fill Material to Waters of the State (Procedures). Among other provisions, the Procedures define certain "wetlands" as "waters of the State" under Porter-Cologne. The Procedures also provide a jurisdictional framework for the determination of aquatic features as "wetlands". Such wetland features under the Procedures are identified and analyzed as "aquatic resources" throughout this document. The Procedures became effective May 28, 2020.

On April 6, 2021, the SWRCB adopted a resolution to confirm that the "State Wetland Definition and Procedures for Discharges of Dredged or Fill Materials to Waters of the State," is in effect as a state policy for water quality control. The resolution also made minor clarifications and changes to the Procedures previously adopted on April 2, 2019.

The January 19, 2017, memorandum of understanding between the Authority and the SWRCB expedites the SWRCB permit process to enable the Authority to meet the FRA construction deadlines for funding. The memorandum of understanding supplements an Interagency Agreement (HSR 16-33) between the Authority and SWRCB. The Authority is currently working with the SWRCB to renew the memorandum of understanding. Until the memorandum of understanding is renewed, the new Procedures note that in cases where the applicant is a state agency and is acting as the CEQA lead agency, and that state agency is a party to an existing written agreement (e.g., memorandum of understanding) with the State Water Board that sets out procedures and requirements, the permitting authority shall apply the terms and conditions of the agreement in lieu of the terms and conditions with the Procedures.

3.7.2.3 Regional and Local

Regional and local plans relevant to biological and aquatic resources include city and county general plans, county ordinances, local tree removal ordinances, the Greenprint (SCVOSA 2014), and the *Coyote Valley Linkage Report* (SCVOSA 2017). Policies and regulations include guidelines that minimize disturbance of vegetation, encourage habitat protection, and support conservation. All regional and local policies that are applicable to the project are listed in Volume 2, Appendix 2-J.

3.7.3 Consistency with Plans and Laws

As indicated in Section 3.1.5.3, Consistency with Plans and Laws, CEQA and CEQ regulations require a discussion of inconsistencies or conflicts between a proposed undertaking and federal, state, regional, or local plans and laws. As such, this Final EIR/EIS describes the inconsistency of the project alternatives with federal, state, regional, and local plans and laws to provide planning context.

There are a number of federal and state laws and implementing regulations, listed in Section 3.7.2.1, Federal, and Section 3.7.2.2 that protect biological and aquatic resources. A summary of the federal and state requirements considered in this analysis follows:

- Federal and state acts and laws that protect jurisdictional wetlands and other waters. Applicable acts and laws include the federal CWA and the state Porter-Cologne Water Quality Control Act.
- Federal and state acts and laws that provide comprehensive requirements for protection and management of special-status species and their habitats and communities. Applicable acts and laws include FESA, the Magnuson-Stevens Act, the U.S. Fish and Wildlife Coordination Act, the MBTA, the BGEPA, Cal. Fish and Game Code (including CESA, Fully Protected Species, Bird Protections, Lake and Streambed Alteration, the NCCPA, and the NPPA), and the Porter-Cologne Water Quality Control Act under the California Water Code.

The Authority, as the lead agency proposing to build and operate the HSR system, is required to comply with all federal and state laws and regulations and to secure all applicable federal and state authorizations prior to initiating construction on the selected alternative. Therefore, there would be no inconsistencies between the project alternatives and these federal and state laws and regulations.

The Authority is not required to comply with local biological and aquatic resource regulations; however, it has endeavored to design and construct the HSR project so that it is compatible with biological and aquatic resource regulations. Avoidance, minimization, and mitigation will be implemented to reduce and compensate for impacts on biological and aquatic resources including implementing biological resource management plans, specific construction protocols, and protection of habitat and species. Analysts reviewed a total of 11 plans with 68 goals, strategies, or polices, and determined that the project alternatives were consistent with all regional and local plans and policies.

3.7.4 Consultation with Regulatory Agencies for Federal Endangered Species Act Compliance

The goal of the FESA is to conserve threatened and endangered species (federally listed species) and the ecosystems on which they depend (16 U.S.C. § 1531 et seq.). Section 7 of the FESA, Interagency Cooperation, establishes the process by which federal action agencies, their designees (e.g., state transportation agencies), and the USFWS and NMFS consult to make certain that proposed actions are not likely to jeopardize the continued existence of species that are listed or proposed for listing as threatened or endangered or result in the destruction or adverse modification of critical habitat. Both agencies share responsibility for implementing the FESA, with the USFWS managing most terrestrial and freshwater species and the NMFS managing marine and anadromous species (e.g., Pacific salmonids).

The implementing procedures of the FESA are outlined in 50 C.F.R. Part 402. Section 7 consultation is required for discretionary federal agency actions taken directly, through one of its own proposed projects or indirectly, through partial or complete funding for a nonfederal project or through issuing a permit for a nonfederal project. Section 7(a)(2) states:

> *Each federal action agency shall, in consultation with and with the assistance of the Secretary [of the Interior], insure that any action authorized, funded, or carried out by such agency (hereinafter in this section referred to as an 'agency action') is not likely to jeopardize the continued existence of any endangered species or threatened*

species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical, unless such agency has been granted an exemption for such action by the Committee pursuant to subsection (h) of this section. In fulfilling the requirements of this paragraph, each agency shall use the best scientific and commercial data available.

In addition, Magnuson-Stevens Act Section 305(b)(2) requires federal agencies to consult with the NMFS regarding actions authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, and which may affect and are likely to adversely affect EFH (50 C.F.R. § 600.920). The Magnuson-Stevens Act requires cooperation among the NMFS, fishery management councils, fishing participants, federal and state agencies, and others in achieving EFH protection, conservation, and enhancement.

3.7.4.1 Consultation History with the U.S. Fish and Wildlife Service: Wildlife

The Authority submitted a BA and requested initiation of formal Section 7 consultation on June 22, 2020.[4] The BA evaluates the potential adverse effects of the project (i.e., proposed action) on species listed as endangered or threatened under FESA, as well as effects on designated or proposed critical habitat. Potential effects on federally listed species will be evaluated in accordance with the legal requirements set forth in Section 7 of FESA (16 U.S.C. § 1531 et seq.). As of September 2021, formal consultation with the USFWS is in progress. An effects evaluation is provided in Section 3.7.11.

3.7.4.2 Consultation History with the National Marine Fisheries Service: Fish

The Authority submitted a BA to the NMFS and requested initiation of formal Section 7 consultation on June 22, 2020. The BA evaluates the potential adverse effects of the project (i.e., proposed action) on fish species identified as endangered or threatened under FESA, as well as effects on designated or proposed critical habitat and EFH. A preliminary effects evaluation is provided in Section 3.7.11. NMFS responded to the request to initiate formal consultation on July 7, 2020, and requested additional information. The Authority met with representatives from NMFS several times to discuss information needs and subsequently submitted a revised BA on October 14, 2020. On October 22, 2020, NMFS found the supplementary information and revisions to be sufficient and initiated formal consultation. On June 24, 2021, NMFS completed formal consultation and issued the Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the San Jose to Merced Project Section.

3.7.5 Methods for Evaluating Impacts

The evaluation of impacts on biological and aquatic resources is a requirement of the National Environmental Policy Act (NEPA) and CEQA. The following sections define the RSAs and summarize the methods used to analyze impacts on biological and aquatic resources.

3.7.5.1 Definition of Resource Study Area

As defined in Section 3.1, Introduction, RSAs are the geographic boundaries in which the environmental investigations specific to each resource topic were conducted. The RSA for impacts on biological and aquatic resources encompasses the areas directly or indirectly affected by construction and operations of the project. These areas include the project footprint for each of the project alternatives plus an additional distance from the project footprint where construction and operations could result in indirect impacts on biological and aquatic resources. Specific RSA boundaries vary by biological and aquatic resource, as shown in Table 3.7-1 and illustrated on Figure 3.7-1 and Figure 3.7-2. The wildlife movement RSAs are illustrated on Figure 4-1 of the WCA (Appendix C of the Biological and Aquatic Resources Technical Report [Authority 2020a]). The

[4] Pursuant to 23 U.S.C. Section 327, under the NEPA Assignment Memorandum of Understanding between the FRA and the State of California, effective July 23, 2019, the Authority has been assigned FRA's FESA Section 7 (16 U.S.C. § 1536) responsibilities for consultations (formal and informal) with respect to the project extent and other projects described in subpart 3.3 of the Memorandum of Understanding.

project footprint is the area that would be physically affected by construction and operations of the project (including temporary disturbance) and the location of permanent HSR facilities and activities. The project footprint includes the limits of cut and fill plus all access roads and areas required for operating, storing, and refueling construction equipment.

Table 3.7-1 Definition of Biological and Aquatic Resource Study Areas[1]

Type	Area of Impact	Boundary Description
Habitat Study Area		
Core Habitat Study Area		
Direct Impacts[2]	Project footprint (includes permanent and temporary impacts)	Area in which potential direct and indirect impacts on special-status wildlife species and their habitat were evaluated. Ground-based site assessments or surveys were conducted in this area, if accessible.
Indirect Impacts[2]	Project footprint plus 250-foot buffer	
Indirect Bisected Impacts (vernal pool species)[3]	Project footprint plus the entirety of vernal pool coverage	
Auxiliary Habitat Study Area		
Indirect Impacts	250- to 1,000-foot buffer outside core habitat study area	Area in which indirect impacts on special-status wildlife species and their habitat were evaluated. Habitat assessed through extrapolation of field observations made in the core habitat study area, aerial photograph interpretation, or windshield surveys.
Aquatic Resource Study Area		
Direct Impacts[2]	Project footprint	Evaluate direct and indirect impacts on aquatic resources.
Indirect Impacts[2]	Project footprint plus 250-foot buffer	
Indirect Bisected Impacts[3]	Project footprint plus the entirety of vernal pool coverage	If a portion of the vernal pool or swale is within the project footprint and therefore directly affected, then the whole vernal pool or swale is considered directly affected for purposes of impact methodology analysis.
Special-Status Plant Study Area[4]		
Direct Impacts[2]	Project footprint	Evaluate direct and indirect impacts on upland sensitive plant resources (including special-status plants, special-status plant communities, and protected trees). For vernal pool plant species, the aquatic RSA and auxiliary study area (if applicable) are used to evaluate impacts.
Indirect Impacts[2]	Project footprint plus 100-foot buffer	

Type	Area of Impact	Boundary Description
Regional Resource Study Area		
Direct and Indirect Impacts	Habitat study area plus larger area defined by ecoregion and/or county boundaries as follows: ▪ North—mostly Santa Clara, Stanislaus, and Merced County boundaries ▪ East—San Joaquin Basin ecoregion boundary, Merced County boundary, and Southern Hardpan Terraces ecoregion boundary ▪ South—Merced County boundary and the following ecoregion boundaries from east to west: Upper Santa Clara Valley, East Bay Hills/Western Diablo Range, Westside Alluvial Fans and Terraces, and San Joaquin Basin ▪ West—Santa Clara County boundary	Area used for developing species habitat models and identifying potential mitigation options. Biologists designed the regional RSA to encompass the habitat study area and to meet the following additional criteria: ▪ The regional RSA should capture a sufficient portion of each species' range, suitable habitat, and known occurrences to enable evaluation of an array of viable mitigation opportunities. ▪ Mitigation should be provided in geographic proximity to project impacts. ▪ Mitigation of project impacts on aquatic resources should primarily occur in or near the watersheds in which they occur. ▪ The regional RSA should be broad enough to allow for a landscape-level analysis of impacts and mitigation options that consider wildlife linkages, priority acquisition areas, proximity to existing conservation lands, and other key attributes. ▪ The regional RSA should be sufficiently focused to limit unnecessary data collection and processing for species modeling and mitigation analysis.
Wildlife Movement Resource Study Areas		
Wildlife Movement Study Area[5]		
Direct and Indirect Impacts	Project footprint plus 5- to 15-mile buffer	Area in which wildlife movement permeability was analyzed on a local scale using a (1) GIS-based resistance-surface model for terrestrial species and (2) a qualitative assessment for aquatic and aerial species.
Local Permeability Analysis Study Area		
Direct and Indirect Impacts	Project footprint plus 1.9-mile buffer	Area in which wildlife movement permeability was quantitatively modeled using GIS. Based on Beier et al. (2008) recommendation of 6-kilometer minimum distance between source and destination locations in GIS models.

Type	Area of Impact	Boundary Description
Groundwater Inflow Aquatic Resources Study Area[6]		
Indirect Impacts	Project footprint (including underground tunnel right-of-way) plus 1-mile buffer	Area in which groundwater (deep aquifer) may be affected during tunnel construction. The one-mile wide RSA is based on the area evaluated for groundwater effects from construction of the SFPUC's New Irvington Tunnel (SFPUC 2009), which was constructed through the Diablo Range approximately 50 miles north-northwest of Pacheco Pass and the construction of the Arrowhead Tunnels in the San Bernardino Mountains in southern California in which monitoring indicated impacts occurred out to 1.1-mile of the tunnel alignments (Berg 2012). Surface water features of biological value include wetlands, streams, and ponds fed by groundwater as well as any riparian vegetation growing adjacent to such features. Upland wildlife species not dependent on surface water features would not be affected by potential groundwater reduction. Non-riparian upland plants would only be affected by potential groundwater reduction if they had sufficiently deep roots to reach relatively shallow areas of groundwater, which is usually limited to oak trees.

Source: Authority and FRA 2017

[1] Study areas were selected considering the resources (species and other biological resources) potentially affected, impact mechanisms, agency guidelines, and professional judgement.

[2] Vernal pools located within the project footprint, and those partially located within the footprint, were considered to be directly and permanently affected in their entirety (i.e., the entire vernal pool was considered to be permanently affected if any part of the vernal pool was affected). Vernal pools located within 250 feet of the project footprint, but not within the project footprint, were considered to be potentially indirectly affected out to 250 feet from the project footprint. This method was used because it is the most inclusive of the potential project impacts and considering limitations on field surveys and direct observations.

[3] Indirect bisected impacts apply in circumstances where a vernal pool falls partially within the project footprint and extends into adjacent areas, including areas beyond 250 feet, and includes impacts on regulated aquatic resources as well as vernal pool wildlife and plant species.

[4] Impacts on special-status plant species occurring in vernal pools are also considered in the context of the aquatic RSA and the auxiliary habitat study area (as applicable).

[5] A detailed description of the wildlife movement study area and the methods used to determine its parameters is presented in Appendix C, Wildlife Corridor Analysis, of the Biological and Aquatic Resources Technical Report (Authority 2020a).

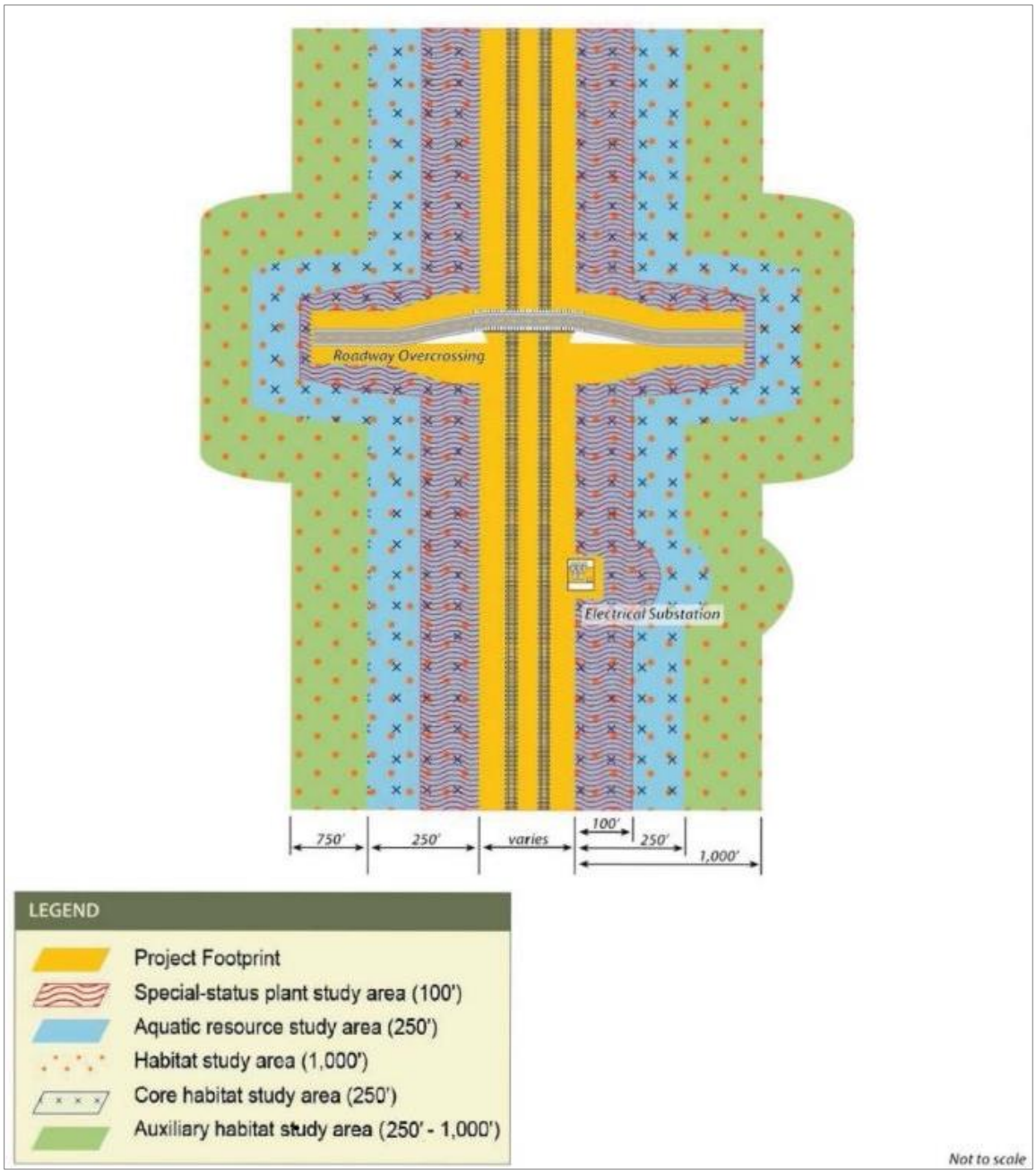
[6] Groundwater inflow aquatic resources RSA not depicted on Figure 3.7-1 due to scale limitations.

A "supplemental habitat study area," which Version 5 Environmental Methods states "*can* be identified for specific species, as required by regulatory agencies or standard protocols," and "extends up to 10 miles from the project footprint, depending on the target species," is not used in this Final EIR/EIS because the regional RSA includes all known species occurrences and habitat in the region.

GIS = geographic information system

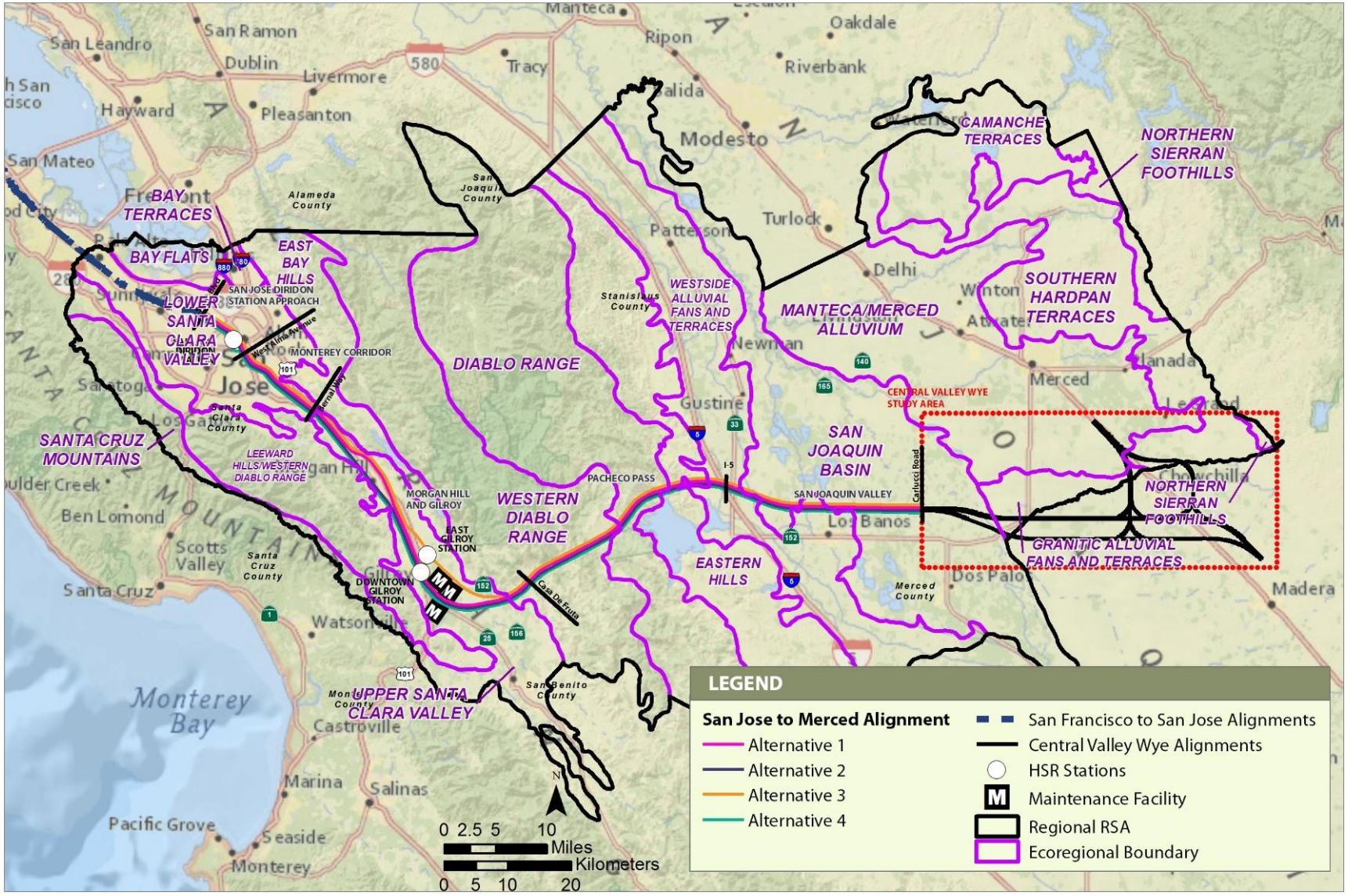
RSA = resource study area

SFPUC = San Francisco Public Utility Commission



OCTOBER 2016

Figure 3.7-1 Schematic of Biological Resource Study Areas



Sources: USEPA 2011; USFS 1994

FEBRUARY 2019

Figure 3.7-2 Regional RSA, Ecoregion, and County Boundaries

3.7.5.2 Impact Avoidance and Minimization Features

IAMFs are project features that are considered to be part of the project and are included as applicable in each of the alternatives for purposes of the environmental impact analysis. The full text of the IAMFs that are applicable to the project is provided in Volume 2, Appendix 2-E. The following IAMFs are applicable to the biological and aquatic resources analysis:

- BIO-IAMF#1: Project Biologist
- BIO-IAMF#2: Agency Access
- BIO-IAMF#3: Construction Period WEAP Training
- BIO-IAMF#4: Operation and Maintenance Period WEAP Training
- BIO-IAMF#5: Prepare and Implement a Biological Resources Management Plan
- BIO-IAMF#6: Establish Monofilament Restrictions
- BIO-IAMF#7: Prevent Entrapment in Construction Materials and Excavations
- BIO-IAMF#8: Delineate Equipment Staging Areas and Traffic Routes
- BIO-IAMF#9: Dispose of Construction Spoils and Waste
- BIO-IAMF#10: Clean Construction Equipment
- BIO-IAMF#11: Maintain Construction Sites
- BIO-IAMF#12: Design the Project to be Bird Safe
- HMW-IAMF#3: Work Barriers
- HMW-IAMF#6: Spill Prevention
- HYD-IAMF#2: Flood Protection
- HYD-IAMF#5: Tunnel Design Features and Construction Methods
- NV-IAMF#1: Noise and Vibration

This environmental impact analysis considers these IAMFs as part of the project design. In Section 3.7.7, Environmental Consequences, each impact narrative describes how these project features are applicable and, where appropriate, effective at avoiding or minimizing potential impacts to less than significant under CEQA.

3.7.5.3 Methods for Impact Analysis

Overview of Impact Analysis

This section describes the sources and methods the Authority used to analyze potential project impacts on biological and aquatic resources. Sections 3.7.5.4, Method for Evaluating Impacts under NEPA, and 3.7.5.5, Method for Determining Significance under CEQA, describe the methodologies used to evaluate project impacts pursuant to NEPA and CEQA. Laws, regulations, and orders (see Section 3.7.2, Laws, Regulations, and Orders) that regulate biological and aquatic resources were also considered in the evaluation of impacts. Data collected from local municipalities such as local and regional land use plans, transportation plans, subarea plans, and other relevant planning documents established the projected planned development along the project extent.

Pre-Field Investigation and Consultation

This section describes the methodology for obtaining information on biological and aquatic resources in the project vicinity (i.e., regional RSA). All information was obtained through reviews of public datasets (e.g., the California Natural Diversity Database [CNDDB]) and previous environmental documentation of the project (Authority and FRA 2011).

Land Cover Mapping

Biologists created preliminary maps of vegetation and land cover types in the auxiliary habitat study area using National Agriculture Imagery Program 2016 imagery as a base map and ArcGIS 10.3 software. A mapping scale of 1 inch = 200 feet (1:2,400) was used. A minimum mapping unit of 1.0 acre was used for wetland complexes, and a minimum mapping unit of 0.25 acre was used for stand-alone wetlands. A minimum mapping unit of 10 acres was used for all other land cover types, but a smaller unit was used where discrete boundaries and types could be discerned. Natural and constructed watercourses were mapped as line features then attributed with their average width. Features wider than 40 feet were mapped as polygons. Terrestrial land cover types were classified in accordance with the unpublished 2011 *Administrative Draft San Jose to Merced Section Biological Resources and Wetlands Technical Report* (2011 San Jose to Merced Section Technical Report), or identified using the *Manual of California Vegetation* (Sawyer et al. 2009; CNPS 2017) or the *California Wildlife Habitat Relationships Habitat Classification Scheme* (CWHR System) (CDFG 1988). Aquatic land cover types were further classified in accordance with the USFWS *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979).

Special-Status Species

Biologists consulted the following sources to identify special-status plant and wildlife species that could potentially be affected by the project:

- **USFWS Species Lists**—Biologists obtained official lists of federal candidate, proposed, threatened, and endangered plant and wildlife species potentially affected by activities in the regional RSA from the San Francisco Bay-Delta, Sacramento, and Ventura Fish and Wildlife Offices using the USFWS Environmental Conservation Online System's (ECOS) Information for Planning and Conservation website (Authority 2020a: Appendix A).
- **NMFS Species List**—Biologists obtained an official list of federal candidate, proposed, threatened, and endangered fish species potentially affected by activities in the regional RSA from NMFS (Authority 2020a: Appendix A).
- California Fish and Game Commission findings regarding petitions to list species under the CESA (California Fish and Game Commission 2020).
- **CNDDB**—Biologists queried the CNDDB geographic information system (GIS) dataset (CDFW 2018b) for occurrences of special-status plant and wildlife species within 10 miles of the HSR centerlines for the project alternatives.
- **CNPS Online Inventory of Rare and Endangered Plants of California (CNPS Online Inventory)**—To identify additional special-status plants not captured by the official USFWS species list or CNDDB, botanists obtained "nine-quad" species lists (i.e., query of USGS 7.5-minute quadrangle map and surrounding eight quads) for each of the USGS quads intersected by the project alternatives from the CNPS Online Inventory (CNPS 2017). From these lists, botanists identified species with very localized distributions (i.e., limited to only a few known localities) outside the special-status plant study area and eliminated them from further consideration. The CNPS Online Inventory is a credible and widely recognized resource used by conservationists, consultants, planners, researchers, and resource managers to obtain information about California's rare plants.
- 2011 San Jose to Merced Section Biological and Aquatic Resources Technical Report (Authority and FRA 2011).
- Species accounts in Appendix D of the SCVHP (County of Santa Clara et al. 2012).
- *Historical Distribution and Current Status of Steelhead/Rainbow Trout (*Oncorhynchus mykiss*) in Streams of the San Francisco Estuary, California* (Leidy et al. 2005).

The official USFWS and NMFS species lists, CNDDB list, and CNPS lists used to inform this effort are provided in Appendix A, Official Species Lists, of the Biological and Aquatic Resources

Technical Report (Authority 2020a). Complete lists of special-status plants (Table B-1) and wildlife (Table B-2) considered for the impacts analysis are provided in Appendix B, Special-Status Species Considered, of the technical report.

Critical Habitat

Biologists identified federally designated critical habitat in the habitat study area by importing USFWS and NMFS geospatial data (i.e., ArcGIS shapefiles from ECOS [USFWS 2016a] and NMFS [2018], respectively) into GIS and overlaying with the regional RSA boundary. Biologists also reviewed the PCE descriptions for applicable species in their respective critical habitat publications in the Fed. Reg. to inform subsequent comparisons with species habitat models.

Essential Fish Habitat

Biologists identified federally designated EFH in the habitat study area by consulting the EFH Mapper online mapping tool maintained by the NMFS (2017). Since the data displayed by the EFH Mapper is somewhat coarse, biologists also reviewed the *Identification and Description of Essential Fish Habitat, Adverse Impacts, and Recommended Conservation Measures for Salmon* report attached to the Pacific Coast Salmon Fishery Management Plan (PFMC 2014) to identify specific USGS hydrologic units designated as EFH.

Non-Special-Status Wildlife

Project biologists collected background information on non-special-status wildlife resources potentially occurring in the habitat study area from several sources. Most information on native wildlife species likely to occur in the habitat study area is based on the collective knowledge of project biologists and conservation planners that have been working in central California for 15–30 years and on standard wildlife references (Stebbins 2003; Reid 2006; CDFW 2018b). Additional information on breeding birds was compiled from the *Breeding Bird Atlas of Santa Clara County, California* (Bousman 2007), eBird (Sullivan et al. 2009), and communications with local birders. Information on waterfowl and shorebird use of large wetlands (i.e., Soap Lake, GEA) was compiled from public comments received during stakeholder meetings and outreach efforts, eBird reports, the National Audubon Society's Important Bird Areas (IBA) program (National Audubon Society 2017a, 2017b), the Western Hemisphere Shorebird Reserve Network website (WHSRN 2017), and the scientific literature. Biologists identified native bat species potentially roosting in the habitat study area by reviewing range maps and habitat information in the online species accounts maintained by the Western Bat Working Group (Western Bat Working Group 2017).

Special-Status Plant Communities

Biologists identified special-status plant communities potentially occurring in the special-status plant study area by reviewing the same CNDDB query conducted for special-status plants and wildlife (CDFW 2018b). Biologists also reviewed plant communities with state rankings of S1–S3 in the CDFW's Sensitive Communities List (CDFW 2018a) to identify additional special-status plant communities that could occur, based on the preliminary vegetation and land cover mapping effort described in Land Cover Mapping earlier in this section.

Aquatic Resources

Biologists reviewed the following resources to obtain information on aquatic resources that may occur in the aquatic RSA:

- USGS 7.5-minute topographic quadrangles that overlap with the aquatic RSA
- National Wetland Inventory maps (USFWS 2016b)
- National Hydrography dataset; BIOS dataset (USGS 2017a)
- Soil survey map units (NRCS 2016, 2017a)
- Google Earth Pro aerial photographs from 2003 to 2017 (Google 2018)
- Climate and precipitation data (NRCS 2017b)

Protected Trees

To identify the requirements for protected trees, biologists reviewed county and city ordinances and codes, as well as available general plans and HCPs. Protected trees in the special-status plant study area were identified based on the regulations summarized in Volume 2, Appendix 2-J.

Wildlife Exposure to Train Noise

Potential wildlife exposure to train noise was identified by determining the maximum noise levels that would be produced by operational trains and the frequency with which trains would operate. Noise levels at various distances from the train were determined by use of an acoustic model. Existing noise levels at various locations on the landscape were determined with reference to noise monitoring data presented in Appendix B of the *Noise and Vibration Technical Report* (Volume 2, Appendix 3.4-A). Potential presence of wildlife in different portions of the alignment was determined with reference to species models discussed in the above section *Special-Status Species*, and effects of train noise on wildlife movement were assessed using sources cited in the following section *Wildlife Movement*. Effects of train noise on wildlife behavior were determined by reference to published literature. For further detail on methodology and citations to the relevant literature, see Appendix 3.7-E.

Wildlife Exposure to Artificial Lighting

Potential wildlife exposure to artificial light at night (ALAN) was evaluated in the context of baseline lighting conditions in the region, an evaluation of the construction and operations nighttime lighting sources, and a review of existing literature regarding the effects of ALAN on wildlife and wildlife movement. For further detail on the methodology, analysis, and citations relevant to ALAN, see Appendix 3.7-F.

Wildlife Movement

The Authority prepared a WCA (Appendix C of the Biological and Aquatic Resources Technical Report [Authority 2020a]) to address impacts on wildlife movement and to support the EIR/EIS. Section 5.2 of the WCA summarizes the references used to identify regional and local wildlife movement corridors. Major references included in the WCA as well as several used to specifically inform this Final EIR/EIS include the following:

- *Bay Area and Beyond Critical Linkages* report (Penrod et al. 2013)
- *Safe Passage for Coyote Valley* report (Phillips et al. 2012)
- *Coyote Valley Linkage Assessment Study* (Diamond and Snyder 2016)
- *The Nature Conservancy's Pajaro Study 2012–2013* (Diamond and Snyder 2013)
- *Wildlife Permeability and Hazards across Highway 152 Pacheco Pass: Establishing a Baseline to Inform Infrastructure and Restoration* (Pathways for Wildlife 2020)
- *The Effects of Spatial and Temporal Scale on Conservation Planning and Ecological Networks in the Central Valley, California*; Ph.D. dissertation by Patrick Huber (2008)
- Tule elk radio collar data from CDFW (Hobbs 2017)
- *Where the Tule Elk Roam: Home Range, Movement Barriers, and Wildlife Overcrossing Placement* (Dziegiel 2021)
- *California Wildlife Barriers 2020* (CDFW 2020a)
- Pathways for Wildlife Pacheco Pass Monitoring June 2021 Update (Diamond 2021)

Conservation Areas

To identify conservation areas (i.e., conservation easements, public lands, conservation and mitigation banks), two primary sources were used:

- **California Protected Areas Database (CPAD)**—Database containing GIS data about lands that are owned in fee and protected for open-space purposes (i.e., national parks, national forests, wildlife refuges, land trust preserves, Bureau of Land Management land, state parks, county parks, neighborhood parks, and other open spaces) (GreenInfo 2016a).
- **California Conservation Easement Database (CCED)**—Database containing GIS data about lands protected under conservation easements (GreenInfo 2016b). It is a parallel dataset to CPAD.

Additionally, local conservation agencies and organizations (e.g., The Nature Conservancy) were contacted to obtain any additional parcels not yet recorded in CCED.

Habitat Conservation Plans

Federal HCPs overlapping with the project were identified by accessing the USFWS Conservation Plans and Agreements Database in ECOS (USFWS 2017a) and reviewing adopted HCPs within USFWS Region 8.

Field Surveys and Species Habitat Modeling

This section describes field surveys and desktop analyses conducted for the project. The primary limitation of the field surveys and assessments is the lack of access to a large portion of the habitat, aquatic resource, and special-status plant study areas. The Authority has identified all parcels that may be crossed by the project. The Authority sent letters to property owners in 2016, 2017, and 2019 requesting permission to access the identified parcels by survey teams conducting biological, cultural resource, visual, and geotechnical surveys. The Authority saves all returned permission to enter forms and records which parcels have granted permission for access to the survey teams. Property owners who have granted access to their property are given a 48-hour notice before survey teams enter the parcel. Some property owners have indicated that they may permit entry to their property at a later date. At the time of preparation of this document, permission to enter had been granted for some properties, but access to most properties had not been granted; accordingly, most biological resource information is based on desktop analyses, including habitat modeling for special-status species. No protocol-level presence-absence surveys for special-status plants or wildlife have been conducted and therefore they were assumed to be present in areas modeled as habitat. Field surveys conducted as of the time of writing are summarized in Table 3.7-2.

Table 3.7-2 Field Surveys and Personnel

Date(s)	Personnel	Subsection(s)	Purpose
May 4–5, 2016	Angela Alcala Kate Carpenter Matt Ricketts	All	Reconnaissance-level wildlife habitat assessment. Verify/update 2010 land cover mapping (Authority and FRA 2011).
December 16, 2016	Brad Schafer	Pacheco Pass (east of Casa de Fruta)	Reconnaissance-level habitat assessment of proposed geotechnical investigation/boring sites.
January 19, 2017	Shannon Crossen Matt Ricketts	Monterey Corridor Morgan Hill and Gilroy Pacheco Pass San Joaquin Valley	Tour of key wildlife crossings in Coyote Valley with Pathways for Wildlife and SCVOSA (Crossen). Windshield survey of Pacheco Pass and San Joaquin Valley Subsections to familiarize Ms. Crossen with project extent (Ricketts and Crossen).
January 24 and 31, 2017	Ross Wilming Matt Ricketts	Pacheco Pass (south of Lover's Leap)	Reconnaissance-level habitat assessment of proposed geotechnical investigation/boring sites.

Date(s)	Personnel	Subsection(s)	Purpose
January 25, 2017	Matt Ricketts	Pacheco Pass (north of Whiskey Flat)	Reconnaissance-level habitat assessment of proposed geotechnical investigation/boring sites.
April 19, 2017	Matt Ricketts	Pacheco Pass San Joaquin Valley	Reconnaissance-level habitat assessment during Authority-sponsored tour of locations where project footprint overlaps with Reclamation or local water district facilities for affected stakeholders.
April 30–May 1, 2018	Joel Butterworth Kate Carpenter	Morgan Hill and Gilroy San Joaquin Valley	Aquatic resource delineation surveys.
May 21–23, 2018	Joel Butterworth Kate Carpenter	Morgan Hill and Gilroy San Joaquin Valley	Aquatic resource delineation surveys.
April 22–25, 2019	Linnea Spears-Lebrun Lanika Cervantes R. J. Van Sant Kristen Klinefelter Marty Lewis Donna Maniscalco	Morgan Hill and Gilroy Pacheco Pass San Joaquin Valley	CRAM field surveys.

CRAM = California Rapid Assessment Method
Reclamation = U.S. Department of the Interior, Bureau of Reclamation
SCVOSA = Santa Clara Valley Open Space Authority

Reconnaissance Field Surveys

Biologists conduct reconnaissance field surveys of the project extent as access allows (Table 3.7-2). During these visits, biologists collect qualitative information on vegetation and wildlife habitat quality using geotagged digital photographs and field notes. Biologists also collect geospatial information on incidental observations of special-status wildlife using smartphones or tablets (Collector for ArcGIS). At the time of writing, approximately 75 percent of the project extent (i.e., the footprint of all four project alternatives) has been accessed or viewed from adjacent roadways during reconnaissance surveys.

Special-Status Species Habitat Modeling

The Authority prepared GIS species habitat models for the regional RSA. The use of species habitat models was selected because access to the project extent is limited, and modeling allows the Authority to complete impact analyses and permitting efforts despite limited access to properties to conduct field-level biological surveys.

Species habitat models were developed to achieve the following:

- Assess impacts
- Analyze project alternatives
- Place avoidance and minimization features
- Determine mitigation requirements
- Prioritize mitigation opportunities
- Track and report impacts and mitigation

In summary, the models—and the maps generated from them—provide important support for compliance with CEQA, NEPA, Section 7 of the FESA, and Section 2081(b) of the CESA. Moreover, they inform compensatory mitigation planning associated with permitting under Sections 404 and 401 of the CWA and Cal. Fish and Game Code Section 1600. Additional details on species habitat modeling methodology and approach are provided in the technical memorandum prepared for and submitted to the USFWS and CDFW on December 19, 2016 (Appendix D, Species Habitat Modeling Methods Memo, of the Biological and Aquatic Resources Technical Report [Authority 2020a]). The California Fish and Game Commission published a notice of findings on May 1, 2020, to designate the southern California/Central Coast population (evolutionarily significant unit [ESU]) of mountain lion as a candidate species under the CESA. Additionally, the monarch butterfly became a candidate for listing under FESA on December 15, 2020. Information on the status, habitat requirements, and potential presence of both species have been added to Appendix 3.7-A and to a new Appendix 3.7-D. Key elements of the methodology for species habitat modeling are summarized in the following subsections.

Habitat Terminology

Habitat—The environmental conditions that support occupancy of a given organism in a specified area (Hall et al. 1997).

In scientific and lay publications, habitat is defined in many different ways and for many different purposes. For the purposes of this Final EIR/EIS, habitat is defined as the specific places where the physical and biological conditions are assumed present that are required to support occupancy by individuals or populations of a given species. Habitat may be occupied (i.e., species present or recently documented as present) or unoccupied.

The term *habitat* implies suitability because any areas with habitat for a given species are therefore *suitable* for that species. The use of this term in this Final EIR/EIS does not imply presence or absence of a given species, only that the environmental conditions known to support that species are known (through direct observation or expert opinion) or presumed (through habitat modeling) to be present in a specified area. *Occupied habitat* is used only when species occurrence has been verified in a specified area.

Species Modeling Methods

Habitat models bring together information about environmental attributes, species life history, and environmental requirements to create a spatially explicit model of suitable habitat at a regional scale. The models are created and displayed using GIS software (ArcGIS 10.3). Once in GIS, the habitat models can be intersected with the project footprint and resource layers to determine impacts and assess mitigation opportunities.

Biologists developed two types of species habitat models to assess impacts from construction and operations of the project and to identify mitigation opportunities: statistically based and rule based. *Statistically based* models are created using a GIS-based software program that accepts habitat and occurrence data inputs and then selects potentially suitable habitat based on the most statistically significant correlations between model variables. San Joaquin kit fox is the only species for which a statistically based model was used. *Rule-based* models are created using an intersection of habitat parameters in GIS. Typically, this is done using Boolean “and/or” relationships to formulate the habitat distribution. For example, a species would be predicted to occur in an area that has the vegetation community *and* the soil type *and* the correct elevation range where the species is known to occur. To recognize a difference in model complexity between listed and nonlisted species, biologists defined two secondary types of rule-based models: basic

and specific. *Basic* rule-based habitat models were created through an intersection of land cover and geographic range (including elevation range in some cases) datasets in GIS, and were created primarily for nonlisted species. *Specific* rule-based habitat models used land cover and range data; additional parameters such as geology, soil, and hydrological data; and spatial measurements related to species movement and area use to identify potentially suitable habitat.

Biologists selected the rules for basic and specific habitat models based on the scientific literature, listing and recovery documents published by resource agencies, first-hand species knowledge, and prior experience. The rules incorporate analysts' best interpretation of species biology and life history requirements into model parameters. Where existing rule-based species habitat models were available and appropriate, they were applied or adapted to the regional RSA. Existing models were used when possible because most have been previously reviewed by the agencies and species experts. For example, the SCVHP is a permitted HCP that uses habitat models developed through close coordination with resource agency staff. Rule-based habitat models developed for Southern California HSR sections (e.g., Bakersfield to Palmdale) were also considered a source of best available information because the agency and expert review process is farther along than Northern California sections. Accordingly, the final models are considered a source of best available information and are used to guide rule development, model parameter selection, and output review for all overlapping species.

The Biological and Aquatic Resources Technical Report (Authority 2020a) provides detailed information regarding the species for which models were developed, the type of model developed, the iterative process through which models were developed, and the source of the model, if applicable. Habitat was modeled for species determined to have potential to be affected by the project. Species chosen for modeling have range, modeled habitat, and occurrences that overlap with or are near the project footprint.

Some of the impact discussions presented in this analysis group species based on a habitat type that they have in common (e.g., special-status plants; least Bell's vireo, yellow warbler, and yellow-breasted chat in riparian habitat), and where significant impacts occur, similarity of compensatory mitigation (i.e., habitat preservation). In these cases, the impact acreages presented in the discussion reflect the *aggregate* areal extent of all species taken together—in other words, the exterior perimeter of the overlapping boundaries of their mapped habitat, so that land where modeled habitat for more than one species is present is only counted once.

Delineation of Aquatic Resources

The mapping conducted for the delineation of aquatic resources was accomplished largely through the interpretation of high-resolution aerial imagery and review of existing maps. The aerial images reviewed covered a range of dates (approximately 1998–2017), but use of recent imagery was emphasized to support interpretation of typical site conditions. Soil survey maps and supporting information were used to identify the soils' geomorphic setting, hydric status, and drainage characteristics.

The emphasis on mapping using aerial imagery and other sources constrained the precision of the mapping of aquatic resources. Some areas identified as potential waters of the U.S. may not meet the technical criteria. Conversely, some areas identified as terrestrial land cover types may indeed be waters of the U.S., although such areas are expected to be of relatively limited extent because the mapping of aquatic features was approached in a conservatively inclusive manner.

The mapping of aquatic features considered to be waters of the U.S. is subject to verification by the USACE. The Authority submitted an aquatic resources delineation to the USACE, and verification (Preliminary Jurisdictional Determination) by the USACE was completed on December 5, 2019.

Clean Water Act Section 404

Wetland Delineation Methods

Field surveys were conducted in July 2010, May 4 and 5, 2016, January 19, 2017, April 30 and May 1, 2018, and May 21–23, 2018. During field surveys, qualified delineators verified the pre-

field survey aerial imagery mapping where site access was granted or where the features could be viewed from public roads. In addition, where site access was granted, delineators walked meandering transects to visually assess the aquatic RSA for the presence of additional wetland features. Where terrain was accessible, the extent of all observed waters of the U.S. was identified and mapped using a handheld global positioning system (GPS) unit with sub-meter accuracy; in areas where terrain prevented walking transects, GPS points were taken at intervals. Representative photographs were taken of mapped features to document physical characteristics. The landforms, vegetation, hydrology, and soil characteristics were noted. Survey data and personnel were recorded on determination data forms. For properties where access was not granted, delineators conducted "windshield" surveys from public roads using binoculars to compare their field observations with signatures on the aerial imagery mapping and updated boundaries as necessary. All mapping was conducted by wetland specialists experienced in using the methods described in the USACE Delineation Manual (Environmental Laboratory 1987) and the USACE Arid West Supplement (USACE 2008a).

Nonwetland Waters Delineation Methods

Wetland specialists conducted field surveys for and desktop mapping of nonwetland waters in the aquatic RSA. These specialists applied the relevant methods described in *A Field Guide to the Identification of the Ordinary High Water Mark in the Arid West Region of the Western United States* (USACE 2008b) and USACE Regulatory Guidance Letter No. 05-05 (USACE 2005) to conditions observed in the field and to aerial photograph signatures of nonwetland waters. Indicators of the ordinary high water mark that were evaluated in the field were natural lines impressed on banks, stain lines, shelving, changes in soil character, changes in vegetation, destruction of terrestrial vegetation, and the presence of litter and debris.

Porter-Cologne Water Quality Control Act

Generally, waters under state regulation are presently delineated in the same manner as federal waters (including the USACE Delineation Manual [Environmental Laboratory 1987] and the USACE Arid West Supplement [USACE 2008a]) based on a Memorandum of Understanding (MOU) with the Authority and SWRCB dated January 2017. This document identifies waters of the state that fall under SWRCB regulation in the same manner as federal waters, consistent with the MOU. The Authority would be required to adhere to the rules in effect at the time an application for discharges of dredged or fill materials to waters of the state is made to the SWRCB.

California Fish and Game Code Section 1600 et seq.

The area regulated under Section 1600 et seq. of the Cal. Fish and Game Code often extends beyond the limit of waters of the U.S. (i.e., above the ordinary high water mark). For example, waterbodies and stream channels up to the top of the streambank or to the riparian vegetation drip line are typically regulated under Section 1600 et seq., but may not qualify as waters of the U.S. or waters of the state. For the purposes of this analysis, all riparian areas have been mapped to the outer drip line of riparian vegetation and are included as areas potentially regulated by CDFW under Section 1600 et seq. of the Cal. Fish and Game Code.

Impact Types and Mechanisms

Project impacts may be direct (i.e., caused by the activity and occurring in the same time and place) or indirect (i.e., caused by the activity but removed in time or distance, but still reasonably foreseeable). Direct impacts would occur within the project footprint during construction and could be temporary (e.g., habitat loss or disturbance resulting from construction staging and activities but restored to pre-project conditions following construction) or permanent (e.g., removal and conversion of existing habitat to HSR facilities). Direct impacts would also occur during operations and would be intermittent (i.e., not continuous but recurring during rail operations on an episodic or occasional basis throughout the life of the system). Indirect impacts could occur both within and adjacent to the project footprint.

Direct construction impacts on special-status species habitat, special-status plant communities, aquatic resources, and conservation areas were quantified using GIS. Specifically, GIS analysts

calculated areas of impact by intersecting biological and aquatic resource feature layers (e.g., special-status species habitat models) with feature layers in the project design drawings (i.e., project activities). Land cover (including special-status plant communities) and aquatic resource feature layers were generated in the land cover mapping and aquatic resource delineation efforts described earlier in this section. Feature layers for special-status species habitat are equivalent to the species habitat models developed specifically for the project as previously described in Species Modeling Methods. Prior to analysis, GIS analysts converted MicroStation DGN files provided by project engineers to ArcGIS geodatabases to facilitate intersects between design drawing and biological resource feature layers.

Direct and indirect construction impacts on wildlife movement and certain groups of non-special-status wildlife (i.e., waterfowl, shorebirds, and wading birds) were evaluated using a variety of quantitative and qualitative methods, including selection and scoring of focal species (i.e., species whose movement needs are representative of a wider variety of species in a given landscape) and permeability modeling. These methods are described in the WCA (Appendix C of the Biological and Aquatic Resources Technical Report [Authority 2020a]).

Indirect construction impacts and direct intermittent and indirect operations impacts are described qualitatively because it is difficult to measure or predict species' or plant community response to future or far-removed environmental factors, especially at the scale of individual plants or animals. Indirect impacts were assessed based on biologists' understanding of the best available science for a given resource and proposed construction and operations activities.

A key component of describing impacts from construction and operations are the impact mechanisms (i.e., the physical activities associated with the project that could result in effects on biological and aquatic resources). The following categories of impact mechanisms were identified:

- Ground disturbance
  - Construction—Grading, clearing, and excavation needed to construct the project
  - Operations—Minor grading, clearing, and excavation necessary to maintain the project right-of-way
- Vegetation removal
  - Construction—Removal of trees and other vegetation as part of site preparation
  - Operations—Tree pruning or weed management along the right-of-way
- Structure modification/demolition
  - Construction—Modification or removal of existing buildings, bridges, roadways, or other structures
  - Operations—Not applicable: no existing structures would be removed during operations
- Hazardous material and pollutant release
  - Construction—Inadvertent release of hazardous materials (e.g., oils and fluids from construction equipment) into sensitive habitat or aquatic resources
  - Operations—Same as for construction
- Hydrologic modification of surface flows caused by surficial activities
  - Construction—Changes to the hydrology of an aquatic resource, either from a change in topography or temporarily to divert water from a work area
  - Operations—Not applicable: minor ground disturbance during operations would not alter topography to an extent that would result in hydrologic change
- Hydrologic modification of surface water features or flows caused by groundwater inflow during tunnel construction or operations

  - Construction—Changes to the hydrology of an aquatic resource caused by inflow of groundwater during tunneling, associated reduction in the aquifer, and reduction of flow to groundwater-dependent aquatic resources.
  - Operations—Not applicable: as described in Section, 3.8, the tunnels would be watertight, which would prevent groundwater inflow during operations.
- Noise
  - Construction—Noise generated by heavy equipment and workers
  - Operations—Noise generated by passing trains and maintenance activities
- Vibration
  - Construction—Vibration generated by heavy equipment and tunnel-boring activities
  - Operations—Vibration generated by passing trains and maintenance activities
- Visual disturbance
  - Construction—Visual perception of construction activities and human presence by wildlife (e.g., birds, nesting raptors)
  - Operations—Visual perception of passing trains and maintenance activities by wildlife
- Artificial light
  - Construction—Light generated by nighttime construction activities, including tunnel portals
  - Operations—Light generated by passing trains and security at HSR facilities
- Vehicle strike
  - Construction—Movement of construction vehicles (e.g., trucks on temporary access roads)
  - Operations—Movement of passing trains

3.7.5.4 Method for Evaluating Impacts under NEPA

The CEQ NEPA regulations (40 C.F.R. Parts 1500–1508) provide the basis for evaluating project impacts (as described in Section 3.1.5.4, Methods for Evaluating Impacts). As described in Section 1508.27 of these regulations, the criteria of context and intensity are considered together when determining the severity of the change introduced by the project.

- **Context—**For the analysis of impacts on biological and aquatic resources, the context would be the existing resources within the RSA: the status of sensitive communities and species that occur or that could occur along the project corridor; and the regulatory setting pertaining to biological and aquatic resources.
- **Intensity—**For the analysis of impacts on biological and aquatic resources, the intensity or severity of an impact would reflect the magnitude of the change between the existing and projected conditions—specifically, the degree to which the construction and operations of the project could affect these resources.

3.7.5.5 Method for Determining Significance under CEQA

CEQA requires an EIR to identify the significant environmental impacts of a project (CEQA Guidelines § 15126). One of the primary differences between NEPA and CEQA is that CEQA requires a threshold-based impact analysis. Significant impacts are determined by evaluating whether project impacts would exceed the significance threshold established for the resource (Section 3.1.5.4). Based on the CEQA Guidelines, the project would have a significant impact on biological and aquatic resources if it would:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFW or USFWS
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by the CDFW or USFWS
- Have a substantial adverse effect on state- or federally protected wetlands (including but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance
- Conflict with the provisions of an adopted HCP, NCCP, or other approved local, regional, state, or federal HCP

As discussed above, biological resources are regulated by numerous agencies at all levels of government, and there are numerous statutes and regulations that are intended to avoid or minimize impacts on biological resources. Where local governments have developed policies or ordinances for the protection of biological resources within their jurisdictions, a conflict with the policy or ordinance would generally indicate the potential for a significant impact. Similarly, a conflict with an adopted HCP, NCCP, or other approved local, regional, state, or federal HCP, would generally indicate the potential for a significant impact because NCCPs and HCPs are adopted specifically for the protection of biological resources. Conversely, where there is no conflict with a local policy or ordinance or an NCCP or HCP, that would generally indicate that the project would not result in a significant impact related to the resources that are protected by the policy, ordinance, or plan.

Mandatory findings of significance in CEQA Guidelines Section 15065 require the lead agency to determine whether a project may have a significant effect on the environment where substantial evidence indicates that negative impacts may occur on biological resources. Under CEQA's mandatory findings of significance, the project would result in a significant impact if it would:

- Substantially reduce the habitat of a fish or wildlife species
- Cause a fish or wildlife population to drop below self-sustaining levels
- Threaten to eliminate a plant or animal community
- Substantially reduce the number or restrict the range of an endangered, rare, or threatened species

General indicators of significance, based on guidelines or criteria in NEPA or CEQA, and regulatory guidance from FRA include:

- Potential modification or destruction of habitat, movement corridors, or breeding, feeding, and sheltering areas for endangered, threatened, rare, or other special-status species
- Potential measurable degradation of protected habitats, sensitive vegetation communities, wetlands, or other habitat areas identified in plans, policies, or regulations
- Potential loss of a substantial number of any species that could affect the abundance or diversity of that species beyond the level of normal variability
- Potential indirect impacts, both temporary and permanent, from excessive noise that elicits a negative response and avoidance behavior

3.7.6 Affected Environment

3.7.6.1 Physical Conditions

This section describes the physical conditions of the project: its topography, climate, hydrology, and soils. These characteristics are the context for the biological conditions and the biological resource descriptions that follow. Additional details are provided in the Biological and Aquatic Resources Technical Report (Authority 2020a).

Topography

The project is located within three ecological sections: Central California Coast, Central California Coast Ranges, and Great Valley (Miles and Goudey 1998).

Within the Central California Coast section is the Santa Clara Valley subsection. It consists of an alluvial plain in the Santa Clara Valley that extends from Hollister to San Francisco Bay and an alluvial plain along the southwestern side of San Francisco Bay.

Within the Central California Coast Ranges section are three subsections: the Eastern Hills, the Diablo Range, and the Western Diablo Range. The Eastern Hills subsection consists of hills and low mountains in the eastern portion of the Diablo Range as well as some hills south of the Diablo Range. The Diablo Range subsection consists of the steep, mountainous central part of the Diablo Range and steep hills along the east-northeast side of the San Andreas fault between Hollister and Parkfield. The Western Diablo Range subsection consists of mountains with rounded ridges, steep and moderately steep sides, and narrow canyons.

Within the Great Valley section are two subsections: the San Joaquin Basin and the Westside Alluvial Fans and Terraces. The San Joaquin Basin subsection is on floodplains and the basin floor in the middle of the San Joaquin Valley. The Westside Alluvial Fans and Terraces subsection is along the western edge of the San Joaquin Valley, adjacent to the Coast Ranges.

Elevations specifically in the project extent range from approximately 55 feet at the western tip of the project extent in Santa Clara to 1,583 feet at Pacheco Pass. Slopes range from nearly level in the Santa Clara Valley and between Interstate (I-) 5 and the eastern tip of the project extent to approximately 75 percent in the Pacheco Pass area.

Climate

The Mediterranean climate typical of the region consists of cool, wet winters and hot, dry summers. Mean annual temperatures in the project extent range from a low of 36 degrees Fahrenheit (°F) in December to a high of 95°F in July. Approximately 79 to 85 percent of the annual rainfall occurs from November to March (NRCS 2017b). A detailed climate summary is provided in the *San Jose to Merced Project Section Hydrology and Water Resources Technical Report* (Hydrology and Water Resources Technical Report) (Authority 2020b).

Watershed and Hydrology

Watersheds and major hydrological features (based on the NRCS's hydrologic unit code [HUC]-8 watersheds) are illustrated on Figure 3.7-3. The western part of the project extends through a number of watersheds that drain to the San Francisco Bay, including Coyote Creek, Guadalupe River, and Los Gatos Creek, and the Pacific Ocean (Monterey Bay), including Llagas Creek, Pacheco Creek, and Pajaro River. The divide between these watersheds and the San Joaquin River watershed to the east is at Pacheco Pass on the crest of the Coast Range.

The eastern part of the project lies in the southern portion of the San Joaquin River watershed. The San Joaquin River watershed extends from the Sacramento–San Joaquin Delta in the north to the northern boundary of the Tulare Lake Basin in the south, and from the crest of the Sierra Nevada in the east to the crest of the Coast Ranges in the west.

The project extent illustrated on Figure 3.7-3 is located within four HUC-8 cataloguing units: Coyote (HUC 18050003), Pajaro (HUC 18060002), Panoche–San Luis Reservoir (HUC 18040014), and Middle San Joaquin–Lower Chowchilla (HUC 180400001). Prominent water

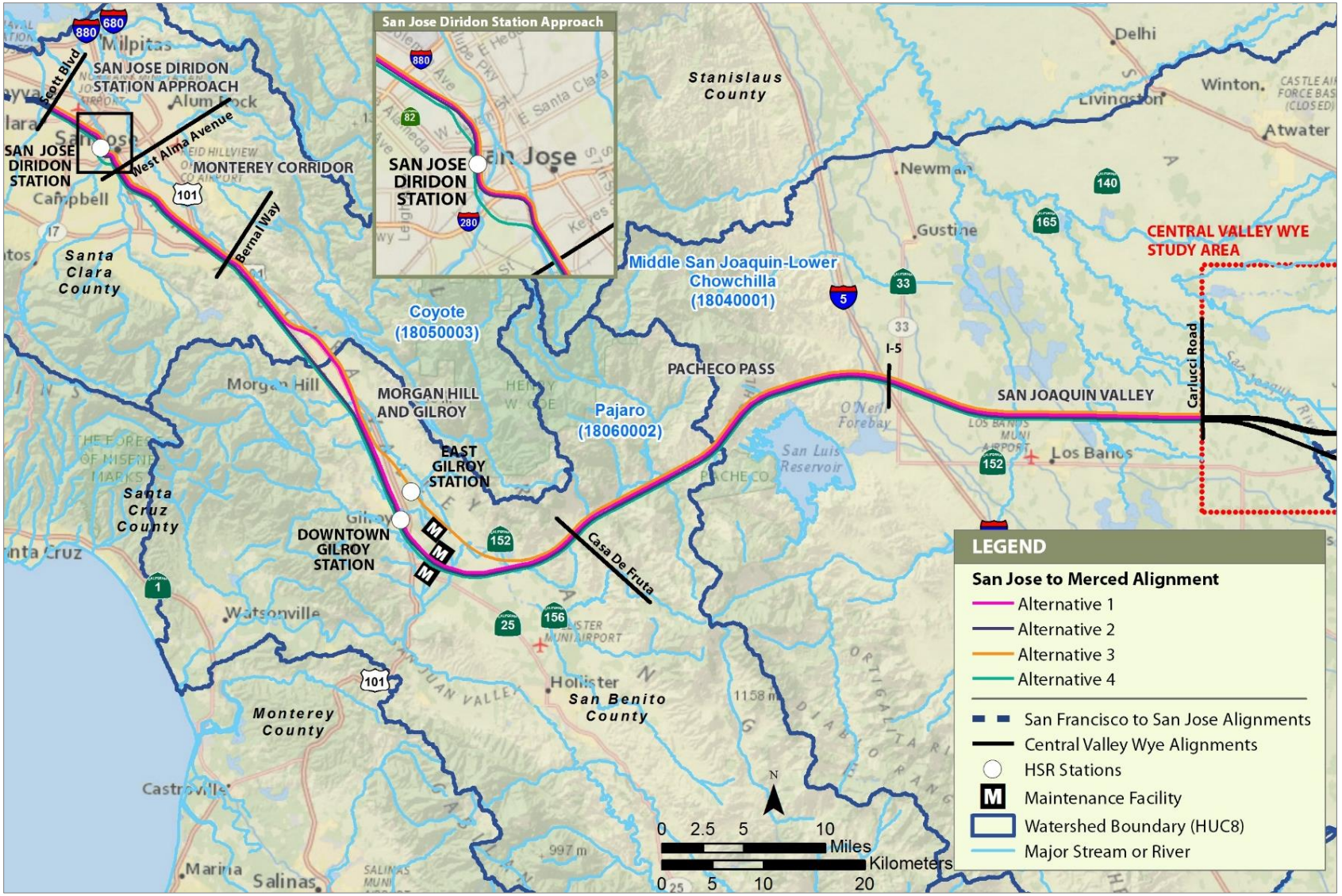
features in the Coyote unit include Coyote Creek, Guadalupe River, and Los Gatos Creek. Prominent water features in the Pajaro unit include Llagas Creek, Pacheco Creek, Pajaro River, San Benito River, Soap Lake, and Uvas Creek. Prominent water features in the Panoche–San Luis Reservoir unit include the Delta-Mendota Canal, California Aqueduct, the San Luis Reservoir, and O'Neil Forebay. Prominent water features in the Middle San Joaquin–Lower Chowchilla unit include the Devon Drain, Mud Slough, Main Canal, and San Luis Wasteway.

Refer to Chapter 5, Existing Conditions and Effects Analysis, of the Hydrology and Water Resources Technical Report (Authority 2020b) for additional information on the hydrologic characteristics in the project extent. (For reference, because of differences in the purposes of the reports, the criteria by which the extent of the waterbodies shown in Table 5-3 of that report were identified and mapped were different from those used in the Biological and Aquatic Resources Technical Report.)

Soils

Analysts reviewed the NRCS (formerly the Soil Conservation Service) Soil Survey Geographic database (NRCS 2017a), State Soil Geographic data (NRCS 2016), and print versions of soil survey reports to describe the general characteristics of the soils in the project extent (Table 3.7-3). The print soil survey reports used were Santa Clara Area (SCS 1958); Supplement to Santa Clara Area, Western Part (NRCS 2015); Eastern Santa Clara Area (SCS 1974); and Merced County, Western Part (SCS 1990). Because of the large area of investigation, soil associations are presented to describe the general distribution of predominant soil series and their associated landforms.

Refer to Section 5.1.2, Soils, of the *San Jose to Merced Project Section: Geology, Soils, and Seismicity Technical Report* (Geology, Soils, and Seismicity Technical Report) (Authority 2019b) for additional information on the soils in the project extent. That report indicates that the soils in the project extent have a wide textural class range (clay to gravelly fine sandy clay loam) and some are underlain by duripans (e.g., San Joaquin series).



Source: USGS 2017

FEBRUARY 2019

Figure 3.7-3 Watersheds and Major Hydrological Features of the San Jose to Central Valley Wye Project Extent

Table 3.7-3 Soil Associations of the San Jose to Central Valley Wye Project Extent

Soil Association (map symbol)	County of Occurrence	Landform
Elnido-Dospalos-Bolfar-Alros (s785)	Merced	Flood plains of the valley basin
Turlock-Triangle-Britto (s786)	Merced	Valley basin and valley basin rim
Dosamigos-Deldota-Chateau (s788)	Merced	Low alluvial fans
Woo-Stanislaus (s789)	Merced	Alluvial fans
Volta-Pedcat-Marcuse (s787)	Merced	Alluvial fans and valley basin rim
Oneil-Apollo (s791)	Merced	Foothills
Los Banos-Damluis-Bapos (s790)	Merced	Terraces
Millsholm-Honker-Gonzaga-Fifield (s793)	Merced	Mountains
Salinas-Mocho-Metz-Cropley (s940)	Santa Clara, San Benito	Fans and terraces
Sheridan-San Benito-Diablo (s964) Montara-Henneke (s683) Vallecitos-Parrish-Los Gatos-Gaviota (s970)	Santa Clara	Uplands
Willows-Pacheco-Clear Lake (s960)	Santa Clara, San Benito	Alluvial fans and plains
Pacheco-Clear Lake-Campbell (s967)	Santa Clara, San Benito	Valley bottoms and alluvial plains
San Ysidro-Pleasanton-Arbuckle (s966)	Santa Clara	Old fans and terraces
Xerorthents-Urban land-Botella (s987)	Santa Clara	Valley bottoms and alluvial fans

Sources: NRCS 2017a

3.7.6.2 Biological Conditions

This section describes the biological conditions of the RSAs. The topics addressed are land cover types, potentially occurring special-status species, non-special-status wildlife, special-status plant communities, aquatic resources, protected trees, wildlife movement, conservation areas, and HCPs. Special-status species potentially affected by the project are summarized in Volume 2, Appendix 3.7-A; the scientific nomenclature of all species mentioned in the text is presented in Volume 2, Appendix 3.7-B.

Land Cover Types

The project extent is located within the California Floristic Province and traverses the San Francisco Bay Area subregion of the Central Western California region, and the San Joaquin Valley subregion of the Great Central Valley region. The San Francisco Bay Area subregion encompasses a diversity of vegetation types, from very wet redwood forest to dry oak/pine woodland and chaparral. The San Joaquin Valley subregion is predominantly agricultural with some grasslands, marshes, vernal pools, riparian woodlands, alkali sink vegetation, and stands of valley oak (Jepson Flora Project 2017).

Table 3.7-4 shows the project-specific land cover types and a crosswalk to the special-status plant communities as defined in the *Manual of California Vegetation* and those in the CWHR, used for habitat modeling. Table 3.7-5 shows the area of land cover within each of the project alternatives. Land cover maps for the habitat study area are provided in Appendix G, Land Cover Maps, of the Biological and Aquatic Resources Technical Report (Authority 2020a). The

Biological and Aquatic Resources Technical Report also describes the vegetation structure and composition of each land cover type in greater detail.

Table 3.7-4 Crosswalk of Land Cover Classification to Other Classification Systems

Land Cover Type	MCV Alliance Crosswalk Type*	CWHR Crosswalk Type (code)	Dominant Species or Other Characteristics
Tree-Dominated			
Blue oak–foothill pine	*Blue oak woodland *Quercus douglasii* Woodland Alliance	Blue oak–foothill pine (BOP)	Blue oak, foothill pine, coast live oak, California buckeye, *Ceanothus* spp., manzanita spp.
California sycamore woodland[1]	*California sycamore woodlands *Platanus racemosa* Woodland Alliance	Valley foothill riparian (VRI)	Western sycamore, valley oak.
Coastal oak woodland	Coast live oak woodland *Quercus agrifolia* Woodland Alliance	Coastal oak woodland (COW)	Coast live oak, California bay, madrone, tanbark oak, canyon live oak
Mixed riparian	Arroyo willow thickets *Salix lasiolepis* Shrubland Alliance *California rose briar patches *Rosa californica* Shrubland Alliance *Blue elderberry stands *Sambucus nigra* Shrubland Alliance *Valley oak woodland *Quercus lobata* Woodland Alliance	Valley foothill riparian (VRI)	Willows, button bush, California rose, elderberries, with few tree species such as Fremont cottonwood, western sycamore, valley oak, white alder
Palustrine forested wetland	*Fremont cottonwood forest *Populus fremontii* Forest Alliance	Valley foothill riparian (VRI)	Fremont cottonwood, western sycamore, valley oak
Shrub-Dominated			
Alkali scrub wetland	*Iodine bush scrub *Allenrolfea occidentalis* Shrubland Alliance	Alkali desert scrub (ASC)	Iodine bush, allscale, saltbush species, shadescale
Coastal scrub	Coyote brush scrub *Baccharis pilularis* Shrubland Alliance	Coastal scrub (CSC)	Coyote bush, California buckwheat, sage species
Mixed chaparral	Scrub oak chaparral *Quercus berberidifolia* Shrubland Alliance Wright's buckwheat patches *Eriogonum wrightii* Dwarf Shrubland Alliance	Mixed chaparral (MCH)	Scrub oak, ceanothus species, manzanita species

Land Cover Type	MCV Alliance Crosswalk Type*	CWHR Crosswalk Type (code)	Dominant Species or Other Characteristics
Herbaceous-Dominated			
Alkali marsh	*Alkali heath marsh *Frankenia salina* Herbaceous Alliance	Alkali desert scrub (ASC)	Cattail, alkali bulrush, salt grass, alkali heath
Alkali vernal pool[2]	*Alkali weed–Salt grass playas and sinks *Cressa truxillensis–Distichlis spicata* Herbaceous Alliance	Alkali desert scrub (ASC)	Fremont's goldfields, salt grass, alkali weed
California annual grassland	Wild oats grasslands *Avena (barbata, fatua)* Herbaceous Semi-Natural Alliance; Annual brome grasslands *Bromus* (*diandrus*, *hordeaceus*)–*Brachypodium distachyon* Herbaceous Semi-Natural Alliance; *Purple needle grass grassland *Nassella pulchra* Herbaceous Alliance	Annual grassland (AGS)	Wild oats, brome species, barley, annual fescues, California oatgrass, hairgrass, sweet vernal grass
Freshwater marsh	California bulrush marsh *Schoenoplectus californicus* Herbaceous Alliance; Cattail marshes *Typha (angustifolia, domingensis, latifolia)* Herbaceous Alliance; Pale spike rush marshes *Eleocharis macrostachya* Herbaceous Alliance; *White-root beds *Carex barbarae* Herbaceous Alliance	Fresh emergent wetland (FEW)	Cattail, bulrush, spike rush
Seasonal wetland	Perennial rye grass fields *Lolium perenne* Herbaceous Semi-Natural Alliance; *Common monkey flower seeps *Mimulus (guttatus) Herbaceous* Alliance; *Creeping rye grass turfs *Leymus triticoides* Herbaceous Alliance	Wet meadow (WTM)	Curly dock, rushes, grasses
Vernal pool	*Fremont's goldfields–Salt grass alkaline vernal pools *Lasthenia fremontii–Distichlis spicata* Herbaceous Alliance	Annual grassland (AGS)	Fremont's goldfields, salt grass

Land Cover Type	MCV Alliance Crosswalk Type*	CWHR Crosswalk Type (code)	Dominant Species or Other Characteristics
Aquatic			
Freshwater pond	No corresponding type	Lacustrine (LAC)	Plankton, duckweed, water lilies; intermittent lacustrine system
Natural watercourse	No corresponding type	Riverine (RIV)	Unvegetated, willows, rushes, cattails
Reservoir	No corresponding type	Lacustrine (LAC)	Plankton, duckweed, water lilies; permanent lacustrine system
Developed			
Commercial/ industrial	No corresponding type	Urban (URB)	Warehouses, industrial plants, greenhouses
Constructed basin	No corresponding type	Lacustrine (LAC)	Detention basins, agricultural ponds
Constructed watercourse	No corresponding type	Riverine (RIV)	Canals, drainage ditches
Ornamental woodland	Eucalyptus groves *Eucalyptus* (*globulus*, *camaldulensis*) Woodland Semi-Natural Alliance	Eucalyptus (EUC)	Nonnative horticultural tree species including Eucalyptus
Urban	No corresponding type	Urban (URB)	Pavement, houses, buildings
Urban landscaping	No corresponding type	Urban (URB)	Lawn grasses, ornamental trees, hedge shrubs
Agricultural			
Agricultural field crops	No corresponding type	Cropland (CRP)	Grain crops
Orchard	No corresponding type	Deciduous orchard (DOR)	Almonds, walnuts, cherries, olives
Row crop	No corresponding type	Irrigated row and field crops (IRF)	Tomatoes, cotton, lettuce
Vineyards	No corresponding type	Vineyard (VIN)	Grapes
Nonvegetated			
Rock outcrop	No corresponding type	Barren (BAR)	Rock (boulders)

Sources: CDFG 1988; CNPS 2017; CDFW 2018a
*Special-status plant community (Natural Community with S1-3 rank)
CWHR = California Wildlife Habitat Relationships
MCV = Manual of California Vegetation
[1] California sycamore woodland is also known as sycamore alluvial woodland.
[2] The alkali vernal pool cover type includes polygons mapped as both individual pools as well as vernal pool complexes (i.e., mosaic of vernal pools and California annual grassland).

Table 3.7-5 Land Cover Types within the Project Footprint and Habitat Study Areas (acres)

Land Cover Type	Alternative 1			Alternative 2			Alternative 3			Alternative 4		
	Project Footprint	Core HSA[1]	Auxiliary HSA[2]	Project Footprint	Core HSA	Auxiliary HSA	Project Footprint	Core HSA	Auxiliary HSA	Project Footprint	Core HSA	Auxiliary HSA
Tree-Dominated												
Blue oak–foothill pine woodland	0.0	0.0	1.2	0.0	0.0	1.2	0.0	0.0	1.2	0.0	0.0	1.2
California sycamore woodland	12.6	15.5	7.1	12.6	15.5	7.1	12.6	15.5	7.1	12.6	15.5	7.1
Coast oak woodland	603.2	908.2	2,318.1	604.3	915.7	2,346.4	607.1	910.1	2,321.9	603.4	904.8	2,323.7
Mixed riparian	26.3	57.0	200.1	27.6	62.4	228.5	30.3	53.9	195.4	20.9	49.3	179.1
Palustrine forested wetland	16.3	31.8	83.2	15.9	31.0	71.9	11.6	27.5	51.4	12.9	25.3	55.0
Subtotal	658.3	1,012.5	2,609.7	660.4	1,024.6	2,655.1	661.5	1,007.0	2,577.0	649.7	994.9	2,566.1
Shrub-Dominated												
Alkali scrub wetland	0.8	9.2	42.3	0.8	9.2	42.3	0.8	9.2	42.3	0.8	9.2	42.3
Coastal scrub	0.9	6.5	16.6	4.6	6.9	13.4	0.9	6.5	16.6	3.5	6.2	21.4
Mixed chaparral	35.9	53.6	216.0	35.9	53.6	215.0	35.3	54.2	216.1	35.9	53.6	212.4
Subtotal	37.6	69.3	274.9	41.3	69.7	270.7	37.0	69.9	275.1	40.2	68.9	276.1
Herbaceous-Dominated												
Alkali marsh	9.7	36.3	204.2	9.7	36.3	204.2	9.7	36.3	204.2	9.7	36.3	204.2
Alkali vernal pool[3]	27.1	2.8	0.0	27.1	2.8	0.0	27.1	2.8	0.0	27.1	2.8	0.0
California annual grassland	1,246.7	2,695.9	6,524.8	1,274.6	2,690.8	6,478.1	1,252.8	2,737.1	6,662.6	1,200.0	2,644.7	6,343.1
Freshwater marsh	2.3	20.7	66.6	2.4	20.9	66.0	11.3	39.6	103.0	2.3	20.8	63.4
Seasonal wetland	15.9	64.5	113.0	16.3	64.6	114.4	13.9	58.2	97.7	11.7	56.6	105.6
Vernal pools	0.4	0.9	0.0	0.4	0.9	0.0	0.4	0.9	0.0	0.4	0.9	0.0
Subtotal	1,302.1	2,821.0	6,908.5	1,330.5	2,816.2	6,862.6	1,315.3	2,874.8	7,067.5	1,251.2	2,762.1	6,716.2

Land Cover Type	Alternative 1			Alternative 2			Alternative 3			Alternative 4		
	Project Footprint	Core HSA[1]	Auxiliary HSA[2]	Project Footprint	Core HSA	Auxiliary HSA	Project Footprint	Core HSA	Auxiliary HSA	Project Footprint	Core HSA	Auxiliary HSA
Aquatic												
Freshwater pond	5.4	18.9	45.8	5.4	18.9	49.0	4.5	15.0	56.6	5.4	18.9	38.3
Natural watercourse	31.5	95.4	164.7	32.2	98.0	166.5	33.1	95.0	174.0	28.6	89.7	161.9
Reservoir	0.1	13.3	97.8	0.2	12.8	100.8	0.1	13.3	97.8	0.0	6.3	91.2
Subtotal	37.0	127.6	308.2	37.8	129.7	316.3	37.7	123.3	328.4	34.0	114.8	291.3
Developed												
Commercial/industrial	62.1	133.2	447.6	66.3	159.6	460.9	80.9	149.8	447.0	60.9	143.2	439.3
Constructed basin	56.6	31.6	118.0	63.3	37.0	114.3	41.3	24.9	88.9	40.7	30.1	114.7
Constructed watercourse	35.3	74.7	117.6	38.7	73.3	108.9	35.8	78.8	120.2	33.0	74.3	111.1
Ornamental woodland	17.4	27.2	83.5	22.0	28.1	91.4	25.2	29.0	79.8	0.9	24.6	90.6
Urban	1,079.5	2,896.7	6,192.4	1,498.3	3,070.1	6,442.9	960.1	2,694.9	5,918.9	801.3	2,764.5	6,205.0
Urban landscaping	33.6	60.8	223.6	28.7	65.0	203.1	33.8	62.4	215.5	3.6	46.3	160.5
Subtotal	1,284.4	3,224.1	7,182.7	1,717.2	3,433.1	7,421.5	1,177.1	3,039.8	6,870.4	940.3	3,083.1	7,121.3
Agricultural												
Agriculture	813.6	1,552.2	4,288.3	874.5	1,634.8	4,264.2	822.8	1,592.1	4,352.8	812.7	1,574.5	4,238.9
Orchard	269.3	332.6	844.8	249.3	293.2	749.7	257.1	362.4	854.2	165.7	269.5	780.4
Row crops	499.2	1,217.3	3,212.1	680.0	1,456.3	3,441.0	680.2	1,491.0	3,489.9	426.3	1,240.7	3,290.8
Vineyard	37.7	62.8	187.0	37.7	63.3	186.9	39.3	65.6	188.1	37.7	62.8	186.8
Subtotal	1,619.7	3,164.9	8,532.1	1,841.5	3,447.5	8,641.9	1,799.4	3,511.1	8,885.1	1,442.3	3,147.6	8,496.9

Land Cover Type	Alternative 1			Alternative 2			Alternative 3			Alternative 4		
	Project Footprint	Core HSA[1]	Auxiliary HSA[2]	Project Footprint	Core HSA	Auxiliary HSA	Project Footprint	Core HSA	Auxiliary HSA	Project Footprint	Core HSA	Auxiliary HSA
Nonvegetated												
Rock outcrop	2.2	3.2	6.9	2.2	3.2	6.9	2.2	3.2	6.9	2.2	3.2	6.4
Subtotal	2.2	3.2	6.9	2.2	3.2	6.9	2.2	3.2	6.9	2.2	3.2	6.4
Total	4,941.3	10,422.7	25,823.1	5,631.0	10,924.1	26,174.9	5,030.2	10,629.1	26,010.2	4,360.1	10,174.7	25,474.4

Source: Calculations generated using ESRI ArcGIS 10.3 from data generated by field surveys and aerial photo interpretation during 2010–2018. Minor differences in the totals are the result of rounding.
Each acreage total includes acreages of utility upgrades, which are mapped from the project footprint to the limit of the core habitat study area (250 feet from the project footprint boundary).
HSA = habitat survey area
[1] Acreage between project footprint and 250-foot buffer outside footprint.
[2] Acreage between 250 and 1,000 feet outside project footprint.
[3] The alkali vernal pool type includes areas mapped as vernal pool complexes. Acreage provided is an estimate of the wetted vernal pool area within vernal pool complexes, consisting of 45% wetted area and 55% upland area.

Special-Status Species

This section addresses special-status plant and wildlife species that have a potential to be affected by the project based on the methods and types of data described in Section 3.7.5.3. Information on the distribution, habitat requirements, threats, and occurrence of special-status species potentially affected by the project are listed in Volume 2, Appendix 3.7-A. As previously noted, the California Fish and Game Commission published a notice of findings on May 1, 2020, to designate the southern California/Central Coast population (ESU) of mountain lion as a candidate species under the CESA. As described in the petition to list the mountain lion, Gustafson et al. (2018) recently identified 10 genetically distinct mountain lion populations in California (with one centered in Nevada but extending into California). The project falls within the central coast north (CC-N) subpopulation (the most northern subpopulation in the ESU), and the project is adjacent to the central coast central (CC-C) subpopulation as described in the petition for listing (Center for Biological Diversity 2019). The petition describes that most of the populations comprising the ESU have low genetic diversity and effective population sizes,[5] and that the divergence of the genetic subpopulations in the ESU is likely the result of habitat fragmentation caused by roads and development. Gustafson et al. (2018) found that the CC-N subpopulation has low observed genetic diversity and resides in areas of significant isolation and habitat fragmentation. The petition describes one metric for minimum viable effective population size (noting that minimum viable effective population size has been found to vary depending on the species). The metric presented is referred to as the 50/500 rule, where an effective population size of 50 is assumed sufficient to prevent inbreeding depression in the short term and an effective population size of 500 is sufficient to retain evolutionary potential in perpetuity. Gustafson et al. (2018) estimated effective population size and total adult population size for each of the six subpopulations within the ESU. The CC-N subpopulation was found to have an effective population size of 17 (16.6) and an estimated total adult population of 33–66 individuals. The CC-C subpopulation has slightly higher estimates and was estimated to have an effective population size of 57 (56.6) and an estimated total adult population of 113–226; however, the petition notes this is still close to the lowest effective population size metric. The petition highlighted that although low effective population size alone is cause for conservation concern, habitat loss and fragmentation due to roads and development have led to extreme levels of isolation and high mortality rates. Several other factors contributing to mountain lion survival and reproduction described in the petition include depredation take, illegal killings (many of which may go undocumented), intraspecific strife, the use of anticoagulant rodenticides, and the mortality of mountain lion cubs (if the mother is killed due to one of the factors listed above). Consequently, the petition notes that there is a high risk of inbreeding depression due to genetic isolation and high mortality rates, and habitat connectivity and habitat protection are needed to assure viable populations.

Additionally, as noted previously, the monarch butterfly became a candidate for listing under FESA on December 15, 2020. Monarch butterfly does not overwinter within the project area; however, it is known to migrate through and to breed within the area. The analysis of listed species (i.e., protected under FESA or CESA) is described in detail in the habitat model descriptions in Appendix E, Species Habitat Model Descriptions, of the Biological and Aquatic Resources Technical Report (Authority 2020a), and, for mountain lion and monarch butterfly, in Appendix 3.7-D to this Final EIR/EIS. Similar information for nonlisted special-status species (e.g., California species of special concern, CRPR 1B) is provided in Appendix B of the Biological and Aquatic Resources Technical Report (Authority 2020a). These tables also include listed and nonlisted species that were considered but determined unlikely to be affected by the project.

Critical Habitat

Designated critical habitat for several listed species occurs in the habitat study area. The specific units for the relevant species are shown by alignment subsection in Table 3.7-6. Critical habitat

[5] Effective population size generally refers to the breeding adults in a population, recognizing that not all adult animals in a population may breed.

designation for the monarch butterfly has not been proposed and will not be proposed unless it is listed under FESA in the future.

Table 3.7-6 Critical Habitat Designations[1] by Subsection

Resource	San Jose Diridon Station Approach	Monterey Corridor	Morgan Hill and Gilroy	Pacheco Pass	San Joaquin Valley
Bay checkerspot butterfly	–	–	Tulare Hill (Unit 6) Hale (Unit 10) San Marin (Unit 12) Kirby (Unit 13)	–	–
Central California coast steelhead	Santa Clara Hydrologic Unit (Coyote Creek, Guadalupe River)	Santa Clara Hydrologic Unit (Coyote Creek, Guadalupe River)	Santa Clara Hydrologic Unit (Coyote Creek)	–	–
South-central California coast steelhead	–	–	Pajaro River Hydrologic Unit (Miller Canal, Llagas Creek, Uvas Creek, Pacheco Creek, Pajaro River)	Pajaro River Hydrologic Unit (Cedar Creek, North Fork Pacheco Creek, Pacheco Creek, South Fork Pacheco Creek)	–
Central Population of California tiger salamander	–	–	San Felipe Unit (EB-12) Lions Peak Unit (10a and 10b)	–	–
California red-legged frog	–	–	Wilson Peak (Unit STC-2)	Wilson Peak (Unit STC-2)	–

Source: USFWS 2016a

[1] Critical habitat designations = critical habitat unit or hydrologic unit names assigned by the U.S. Fish and Wildlife Service or National Marine Fisheries Service in the *Federal Register*, followed by numerical descriptor or streams in parentheses.

Essential Fish Habitat

The habitat study area contains designated freshwater EFH for Pacific coast salmon. Specifically, the Pacific Salmon Fishery Management Plan (PFMC 2014) identifies freshwater EFH for Chinook and coho salmon in the Coyote Creek hydrologic unit (HUC-8 18050003), which is composed of the Saratoga Creek, Guadalupe River, Upper Coyote Creek, and Lower Coyote Creek hydrologic areas. Freshwater EFH for Chinook and coho salmon consists of four major activities: (1) spawning and incubation; (2) juvenile rearing; (3) juvenile migration corridors; and (4) adult migration corridors and adult holding habitat. Chinook salmon EFH includes “all those streams, lakes, ponds, wetlands, tributaries, and other waterbodies currently viable and most of the habitat historically accessible to Chinook salmon within Washington, Oregon, Idaho and California” (PFMC 2014). Coho salmon EFH includes “all habitats currently or historically occupied within Washington, Oregon, and California” (PFMC 2014).

Chinook salmon were once extirpated from Coyote Creek, but have spawned there since at least the mid-1980s. Most spawning has been observed in the lowermost reaches but adults have been observed as far upstream as Metcalf Dam at Anderson Reservoir. Chinook salmon is

assumed to occur in the habitat study area, although it is currently unknown if spawning is successful. The SCVWD last captured a few juveniles in both Coyote Creek and the Guadalupe River during a trapping effort in the late 1990s (Smith 2013).

Coho salmon have been extirpated from all tributaries of San Francisco Bay (CDFW 2020b) and are therefore not expected to occur in the habitat study area. They are only addressed in this analysis as a component of the freshwater EFH designation in the Coyote Creek hydrologic unit.

Non-Special-Status Wildlife

California has an abundant diversity of wildlife, and the regional RSA is no exception. To describe the various wildlife communities in each of the land cover types traversed by the project extent is beyond the scope of this analysis. Instead, this section provides a general summary of common or unique species assemblages known or expected to occur in the habitat study area that do not meet the definition of special-status species in Section 3.7.1.1 and could potentially be affected by construction and operations of the project.

Amphibians and Reptiles

Most amphibian species likely to occur in the habitat study area breed in streams, ponds, or seasonal pools and either remain near aquatic habitat or move into adjacent uplands in the dry season. Sierran treefrog, arboreal salamander, and California slender salamander are fairly common in both developed and natural land cover types as long as seasonal pools or streams are available for breeding and ground cover (e.g., ornamental or native shrubs, dense ground cover or leaf litter) is present. Other species have narrower habitat requirements and only occur in natural land cover types (e.g., riparian and oak woodland/forest, scrub, chaparral, grassland), occasionally venturing onto rural residential lots within or adjacent to natural land cover. Species in this category include California newt, ensatina, and western toad.

Many reptile species adapted to a variety of land cover types are expected to occur in the habitat study area. Western fence lizard and common garter snake are common species in both developed and natural land cover types as long as hard surfaces for basking (e.g., fence posts, rocks, logs, sides of buildings) are present for the former and water is nearby for the latter. Other species have narrower habitat requirements and only occur in natural land cover types, occasionally venturing onto rural residential lots within or adjacent to natural land cover. Species in this category include southern alligator lizard, northern rubber boa, California kingsnake, gopher snake, striped racer, common sharp-tailed snake, ring-necked snake, and western rattlesnake.

Birds

The official checklist of California birds maintained by the California Bird Records Committee (2017) includes 666 species, one of the highest in the United States. The number of species observed in Santa Clara and Merced Counties at the time of writing was 379 and 297, respectively (Sullivan et al. 2009). Recognizing that any of these species could occur in most parts of the habitat study area during all or certain times of the year, the following discussion focuses on four species groups: (1) terrestrial birds likely to nest in the habitat study area (including riparian songbirds), (2) waterfowl, (3) shorebirds, and (4) waterbirds. Much of the information on waterfowl, shorebirds, and waterbirds was compiled from documents or articles associated with the Central Valley Joint Venture (CVJV), a coalition of 20 state, federal, and private partners with the common goal of providing sufficient habitat for migrating and resident birds in the Central Valley of California. The 2006 *Central Valley Joint Venture Implementation Plan* (CVJV 2006) is the primary guiding document for this coalition and outlines conservation goals and objectives for wintering waterfowl, breeding waterfowl, nonbreeding shorebirds, breeding shorebirds, waterbirds, and breeding riparian songbirds.

Nesting Terrestrial Birds

The diversity of terrestrial birds likely to nest in the habitat study area reflects the diversity of vegetation, topography, and land uses along the project extent. Many tree- or shrub-nesting species, including Anna's hummingbird, downy woodpecker, California scrub-jay, oak titmouse, bushtit, and California towhee are just as likely to nest in developed areas as in natural woodland

or scrub. Others, such as American crow, northern mockingbird, and house finch, are more strongly associated with human development. Common tree-nesting raptors in the region include red-tailed hawk, red-shouldered hawk, Cooper's hawk, and great horned owl, all of which are capable of nesting in urban, rural, and natural landscapes as long as suitable trees are present. Killdeer and western meadowlark are the most common ground-nesting species likely to be encountered in barren areas (e.g., open lots of soil or gravel, levees, roadsides, canal edges) and grassland, respectively. Species that nest in, on, or under human structures (e.g., bridges, highway overpasses, culverts, crevices in buildings) in the area include white-throated swift, black phoebe, cliff swallow, and barn swallow. Open-cup- and cavity-nesting species with strong affinities for natural oak woodland include Nuttall's woodpecker, Hutton's vireo, white-breasted nuthatch, orange-crowned warbler, and spotted towhee. Stands of emergent wetland vegetation in and adjacent to ponds, irrigation ditches, and natural wetlands provide nesting habitat for marsh wren, song sparrow, and red-winged blackbird.

Terrestrial songbird species that breed in riparian vegetation have received increased conservation attention in recent decades due to the limited distribution and decline of riparian plant communities. Riparian-breeding songbirds potentially nesting in the habitat study area include Pacific-slope flycatcher, warbling vireo, black-headed grosbeak, song sparrow, common yellowthroat, and spotted towhee. In addition to the latter four species, the 2006 *Central Valley Joint Venture Implementation Plan* identified western yellow-billed cuckoo, yellow-breasted chat, and yellow warbler as "focal species" to develop its conservation objectives for breeding riparian songbirds. Yellow-breasted chat and yellow warbler were included in the habitat modeling effort described in Section 3.7.5.3, and western yellow-billed cuckoo is not expected to occur in the habitat study area.

Waterfowl

Waterfowl in the regional RSA include both wintering and breeding species. Wintering waterfowl are defined as nonbreeding migrating or wintering ducks, geese, and swans using the Central Valley and Santa Clara Valley between August and March (CVJV 2006: page 39). California's Central Valley, including the portion traversed by the project extent, has been documented as one of the most important regions in western North American for wintering waterfowl (Evens and Tait 2005: page 158), and supports up to 60 percent of the total Pacific Flyway population in some years (CVJV 2006: page 39). Wintering dabbling ducks include gadwall, mallard, northern shoveler, northern pintail, and green-winged teal. Wintering diving ducks include canvasback, ring-necked duck, greater scaup, bufflehead, and ruddy duck. Wintering geese or swan species include greater white-fronted goose, snow goose, Ross's goose, cackling goose, Canada goose, and tundra swan. Wintering waterfowl feed in a variety of wetland and agricultural cover types, with managed seasonal wetlands, rice fields (winter-flooded and dry), and corn fields (winter-flooded and dry) identified as especially important in the Central Valley (CVJV 2006: page 46). Several duck species also breed in the habitat study area, with mallards comprising the majority (CVJV 2006: page 39). Other breeding duck species include cinnamon teal, redhead, gadwall, and ruddy duck. In addition to wetlands, breeding waterfowl also require dense upland vegetation to provide cover for their nests.

The project extent crosses two important areas for waterfowl. The first is the GEA in the San Joaquin Valley Subsection, a 160,000-acre mosaic of freshwater wetlands, alkali grassland, and riparian thickets cooperatively managed by a variety of private, state, and federal landowners, including USFWS (San Luis and Merced National Wildlife Refuges, Grasslands Wildlife Management Area), CDFW (Volta, Los Banos, and North Grasslands Wildlife Areas), California State Parks (Great Valley Grasslands State Park), and private duck clubs. Because it supports a half-million individual ducks, geese, and swans each year between November and February, it has been identified as an Audubon IBA (National Audubon Society 2017a). The second is Soap Lake (also known as "San Felipe Lake"), just south of State Route (SR) 152 and approximately 10 miles east of Gilroy. The Morgan Hill and Gilroy Subsection passes through the Soap Lake floodplain between Gilroy and Casa de Fruta. This area is part of the Upper Pajaro River (UPR) (Bolsa de San Felipe) Audubon IBA (National Audubon Society 2017b). Soap Lake and adjacent pastures and agricultural fields to the west and south provide migratory stopover and winter foraging and roosting habitat for waterfowl and shorebirds traveling to, from, or between other

important wintering sites such as South San Francisco Bay, the Monterey Bay lowlands, and the Central Valley (National Audubon Society 2017b). Wintering ducks occur at both sites but are more abundant at Soap Lake (Sullivan et al. 2009). With the exception of Canada goose, wintering geese are more abundant at the Los Banos Wildlife Area than at Soap Lake, though not in the numbers found to the north in the Sacramento National Wildlife Refuge Complex (Evens and Tait 2005: page 166).

Shorebirds

Many species of wintering and breeding shorebirds occur in the regional RSA. Wintering shorebirds are defined as nonbreeding shorebirds that occur between July and May each year (CVJV 2006: page 145). Similar to waterfowl, California's Central Valley has been identified as one of the most important regions for migratory and wintering shorebirds in western North America (Shuford et al. 1998). Permanent wetlands support large numbers of migratory and wintering dunlin, western sandpiper, least sandpiper, greater yellowlegs, long-billed dowitcher, and whimbrel. Among the shorebirds breeding in the Central Valley, only the American avocet, black-necked stilt, and killdeer are widespread, numerous, and nest in a variety of wetland, agricultural, and water treatment or storage cover types (CVJV 2006: page 191). Barren areas such as abandoned levees, dried ponds, exposed mudflats of managed wetlands, and agricultural evaporation ponds provide nesting habitat for these and other breeding shorebirds such as spotted sandpiper and snowy plover (Hickey et al. 2003).

The GEA and Soap Lake (the latter to a smaller extent) are the two areas of primary importance for waterfowl and for wintering and breeding shorebirds along the project extent. The GEA has been identified as an Audubon IBA (National Audubon Society 2017a) and a Site of International Importance by the Western Hemisphere Shorebird Reserve Network (WHSRN 2017) because it seasonally supports nearly 50 percent of all Central Valley shorebirds during the peak of spring migration (mid-April). Wildlife refuges and private duck clubs in the Central Valley (presumably including those within the habitat study area) manage wetlands to benefit shorebirds to some degree but management is habitat- rather than species-based. The main habitat management techniques for shorebirds are water level management, (slow or staggered drawdowns, timing of drawdowns to match periods of peak use), mechanical vegetation control (burning, disking, mowing), and creation of a variety of habitats and varied topography within and among management units (Hickey et al. 2003).

Waterbirds

For the purposes of this analysis, *waterbirds* refer to species addressed by the *North American Waterbird Conservation Plan*, which "provides a continental-scale framework for the conservation and management of 210 species of…seabirds, coastal waterbirds, wading birds, and marshbirds" (Kushlan et al. 2002: page 3). Common waterbird species using wetlands or open water in the habitat study area include western grebe, California gull, Forster's tern, Virginia rail, and sora. Western grebe is also one of the seven focal waterbird species used by the CVJV (2006) to facilitate conservation of Central Valley waterbirds. Other focal species representing different families spanning a range of wetland and riparian conditions include snowy egret, white-faced ibis, black tern, black rail, and sandhill crane. With the exception of snowy egret and white-faced ibis, all of these species are special-status species addressed by species habitat modeling described in Section 3.7.5.3 and Appendix E of the Biological and Aquatic Resources Technical Report (Authority 2020a). Snowy egret is a CVJV focal species because it nests colonially in dense woody vegetation, most commonly in riparian settings. The remainder of this section focuses on colonial nesting herons and egrets because of their sensitivity to disturbance and the increased level of conservation attention by the CDFW and public.

Four species of colonial nesting herons or egrets are common in the habitat study area: great blue heron, great egret, snowy egret, and black-crowned night-heron. Two additional species, little blue heron and cattle egret, are less common but have been documented at a few sites in the San Francisco Bay Area. Trees, including nonnative species (e.g., *Eucalyptus* spp.) near developed areas, are most commonly used as nesting substrates. Colonies may consist of several hundred nests or just a few breeding pairs. Nesting herons and egrets feed primarily in

wetland (and some upland) habitats within a few to several kilometers of their colonies (Kelly et al. 2006: pages 1–3).

Three known heron and egret nesting colonies occur in the habitat study area. The first two colonies are at Coyote Parkway Lakes and Soap Lake in the Santa Clara Valley and are described in the *Annotated Atlas of Heron and Egret Nesting Colonies in the San Francisco Bay Area* (Kelly et al. 2006), a joint research effort by Audubon Canyon Ranch and the San Francisco Bay Bird Observatory. In 2005, great blue herons nested in cottonwood and sycamore trees downstream of the dam at Coyote Parkway Lakes about 150 feet west of U.S. Highway 101 and north of Metcalf Canyon Road. Great blue herons also nested at Soap Lake in 1996, 1998, 2000, and 2001 but not in 2002. Project biologists found the third colony in a stand of cottonwood trees in the San Joaquin Valley during the May 4, 2016, reconnaissance survey. The trees are approximately 500 feet south-southwest of the junction of Fahey Road and Cherokee Road, approximately 3 miles northwest of Volta and 0.2 mile north of the project footprint. Biologists counted approximately 60 nests of at least three species from nearby roads: great blue heron, great egret, and black-crowned night-heron. A focused survey consisting of multiple visits throughout the nesting season would have likely revealed additional nests and possibly additional species (e.g., cattle or snowy egret).

Mammals

A variety of terrestrial mammals occur in the habitat study area. Common burrowing or ground-dwelling rodents expected to occur in developed areas, woodland, scrub, and/or grassland include California ground squirrel, Botta's pocket gopher, western harvest mouse, house mouse, California deer mouse, and California vole). Small to large-sized generalist species adapted to both urban and natural areas include striped skunk, Virginia opossum, northern raccoon, and mule deer. Several carnivore species, including bobcat, coyote, and gray fox occasionally venture into and move through developed areas but spend most of their time in undeveloped areas away from human activity. Other species that primarily occur in natural woodland, scrub, or grassland include American badger, western gray squirrel, and Merriam's chipmunk.

Several common bat species occur and may roost in the habitat study area. Roost sites must have an appropriate temperature regime and offer protection from predators and weather. Roost sites fall into three general categories: crevices, cavities/caves, and foliage. In natural settings, cavity-roosting species roost in groups on open surfaces inside dark chambers, such as caves or large tree hollows; crevice-roosting species roost in a variety of "slots" (e.g., rock crevices, exfoliating tree bark, damaged wood in snags). While some species appear to prefer cavities or crevices for roosting, many species use a variety of roost sites. With the exception of a few foliage-roosting species, all North American bat species also roost in cave-like spaces and/or crevices in built structures such as bridges, tunnels, old mines, silos, towers, and tunnels (H. T. Harvey & Associates 2004). Mexican free-tailed bat, big brown bat, and California myotis are common cavity- or crevice-roosting species in California that may roost under bridges or in large tree hollows, abandoned buildings, rock crevices, mine shafts, or other features in the habitat study area. Hoary bat is a highly migratory foliage-roosting species that may roost in wooded portions of the habitat study area during the spring, summer, and fall. Roosting patterns of these and other bat species potentially occurring in the habitat study area are shown in Table 3.7-7.

Table 3.7-7 Roosting Patterns for Bat Species Potentially Occurring in the Habitat Study Area[1]

Species	Status	Bridge	Cave/ Mine	Building	Cliff/ Rock Crevice	Tree Bark/ Hollow	Tree Foliage
Big brown bat *Eptesicus fuscus*		1	2	1	2	1	

Species	Status	Bridge	Cave/ Mine	Building	Cliff/ Rock Crevice	Tree Bark/ Hollow	Tree Foliage
California myotis *Myotis californicus*		2	2	1	1	2	
Hoary bat *Lasiurus cinereus*							1
Mexican free-tailed bat *Tadarida brasiliensis*			1	2	1	1	3
Pallid bat *Antrozous pallidus*	SSC	1	2	1	2	1	
Townsend's big-eared bat *Corynorhinus townsendii*	SSC	2	1	2		3	
Western mastiff bat *Eumops perotis californicus*	SSC			3	1		
Western red bat *Lasiurus blossevillii*	SSC						1

Source: H. T. Harvey & Associates 2004
SSC = California species of special concern
[1] 1 = use frequently; 2 = use sometimes; 3 = use rarely; blank = not known to use

Special-Status Plant Communities

Twelve special-status plant communities identified as potentially occurring in the regional RSA based on CNDDB search results (CDFW 2018b), were identified as having the potential to occur within the special-status plant study area. Land cover types that qualify as special-status plant communities, or that could contain unmapped occurrences of a special-status plant community, are shown in Table 3.7-8.

Table 3.7-8 Special-Status Plant Communities Potentially Occurring in the Special-Status Plant Study Area

Land Cover Type	Corresponding CDFW Natural Community Name
Alkali marsh	*Frankenia salina* Herbaceous Alliance
Alkali scrub wetland	*Allenrolfea occidentalis* Shrubland Alliance
Alkali vernal pool	*Cressa truxillensis–Distichlis spicata* Herbaceous Alliance
California annual grassland	*Nassella pulchra* Herbaceous Alliance
California sycamore woodland	*Platanus racemosa* Woodland Alliance
Freshwater marsh	*Carex barbarae* Herbaceous Alliance
Mixed chaparral	*Eriogonum wrightii* Dwarf Shrubland Alliance
Mixed riparian	*Rosa californica* Shrubland Alliance *Quercus lobata* Woodland Alliance *Sambucus nigra* Shrubland Alliance
Palustrine forested wetland	*Populus fremontii* Forest Alliance

Land Cover Type	Corresponding CDFW Natural Community Name
Seasonal wetland	*Leymus triticoides* Herbaceous Alliance; *Mimulus (guttatus)* Herbaceous Alliance
Vernal pool	*Lasthenia fremontii–Distichlis spicata* Herbaceous Alliance

Sources: Holland 1986; CDFW 2018a; CNPS 2017, 2018
CDFW = California Department of Fish and Wildlife

Aquatic Resources

Detailed information regarding aquatic resources identified in the aquatic RSA is presented in the Aquatic Resource Delineation Report (Authority 2019a). Summary information is shown in Table 3.7-9.

Table 3.7-9 Aquatic Resources by Subsection

Resource	San Jose Diridon Station Approach	Monterey Corridor	Morgan Hill and Gilroy	Pacheco Pass	San Joaquin Valley
Alkali marsh	–	–	–	–	Yes
Alkali scrub wetland	–	–	–	–	Yes
Alkali vernal pool	–	–	–	–	Yes
California sycamore woodland	–	–	–	Yes	–
Constructed basin	–	Yes	Yes	Yes	Yes
Constructed watercourse	Guadalupe River	Yes (unnamed)	Cochran Channel/Metcalf Creek, SCVWD Percolation Channel, Madrone Channel/Metcalf Creek, West Little Llagas Creek, Butterfield Channel, West Branch Llagas Creek Channel, Upper Miller Slough, San Ysidro Creek, Pajaro River, Millers Canal, Tequisquita Slough, Pacheco Creek Side Channel, Ortega Creek Tributaries	California Aqueduct, Delta Mendota Canal, Outside Canal	Main Canal, San Luis Wasteway, Santa Fe Canal, San Luis Canal, San Luis Drain, San Pedro Canal, Boundary Drain, Lone Tree Canal, Devon Drain, Midway Swamp Ditch, West Delta Canal, Delta Canal, East Delta Canal, Poso Drain, Belmont Drain, Delta No.1 Canal, San Juan Drain, West San Juan No.1 Canal
Freshwater marsh	–	Yes	Yes	Yes	Yes
Freshwater pond	–	–	Yes	Yes	Yes

Resource	San Jose Diridon Station Approach	Monterey Corridor	Morgan Hill and Gilroy	Pacheco Pass	San Joaquin Valley
Mixed riparian	Yes	Yes	Yes	Yes	Yes
Natural watercourse	Guadalupe River, Los Gatos Creek	Guadalupe River, Coyote Creek,	Coyote Creek, Fisher Creek, Little Llagas Creek, Llagas Creek, West Branch Llagas Creek, Dexter Creek, Jones Creek, Uvas-Carnadero Creek, Pajaro River, Miller Slough, Pacheco Creek, Ortega Creek, Pacheco Creek Tributaries	Pacheco Creek, Pacheco Creek Tributaries, Elephant Head Creek, Harper Canyon Creek, San Luis Reservoir Tributary, Cottonwood Creek, Romero Creek	San Luis Creek, Los Banos Creek, Mud Slough
Palustrine forested wetland	Yes	Yes	Yes	Yes	Yes
Reservoir	–	–	Yes	Yes	–
Seasonal wetland	Yes	Yes	Yes	Yes	Yes
Vernal pool	–	–	–	Yes	Yes

SCVWD = Santa Clara Valley Water District

Wetlands

Wetland types identified within the aquatic RSA include alkali marsh, alkali scrub wetland, alkali vernal pool, California sycamore woodland, freshwater marsh, mixed riparian, palustrine forested wetland, seasonal wetland, and vernal pool. Of these wetland types, alkali marsh, alkali scrub wetland, alkali vernal pool, California sycamore woodland, seasonal wetland, and vernal pools are considered special-status species habitat or special-status plant communities (see the preceding subsection, Special-Status Plant Communities). For the purposes of this analysis, riparian communities are considered wetlands if they meet the USACE definition of wetlands (i.e., they meet the three-parameter approach outlined by the USACE).

All wetlands identified within the aquatic RSA are considered subject to CWA jurisdiction based on the Preliminary Jurisdictional Determination option as described in the Jurisdictional Determinations, Regulatory Guidance Letter 16-01 (USACE 2016). Wetlands are described in Land Cover Types earlier in this section.

Other Waters of the U.S.

Nonwetland waters investigated in the aquatic RSA are constructed basin, constructed watercourse, freshwater pond, natural watercourse, and reservoir. Nonwetland waters are described in Land Cover Types earlier in this section. All natural and constructed waterways are considered potentially subject to CWA jurisdiction under the Preliminary Jurisdictional Determination format (USACE 2016).

Streams, Lakes, and Rivers

Streams, lakes, and rivers identified within the aquatic RSA and potentially regulated under Cal. Fish and Game Code Section 1600 et seq. include natural watercourses, freshwater ponds,

reservoirs, and constructed watercourses. Additionally, riparian habitat types adjacent to these features may also be regulated, including California sycamore woodland, mixed riparian, and palustrine forested wetland. The extent of streams, lakes, and rivers (including adjacent riparian habitats) is similar to the extent of wetlands and other waters of the U.S., with some differences primarily in the extent of riparian habitat types.

Waters of the State

Waters under state regulation are the same as federal waters discussed above based on a Memorandum of Understanding (MOU) with the Authority and SWRCB dated January 2017. This document identifies waters of the state that fall under SWRCB regulation in the same manner as federal waters, consistent with the MOU.

Protected Trees

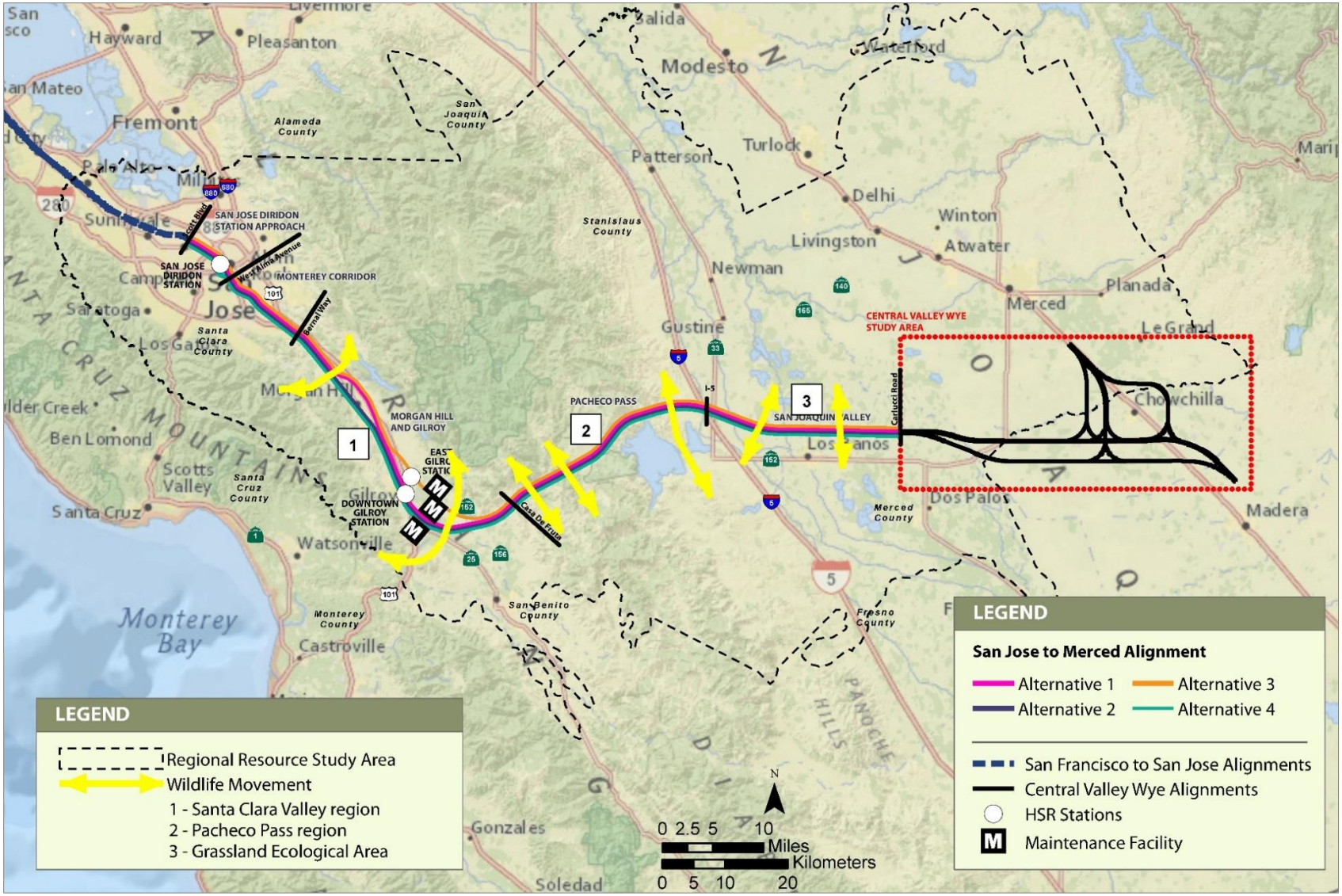
Based on reconnaissance field surveys and GIS analysis of the project extent, several land cover types that contain trees are located within the special-status plant study area. Although some of the trees may not be protected under local ordinances, regulations, and policies, a number of them are protected. Table 3.7-10 shows results of GIS analysis of the protected tree habitat locations within each subsection of the project extent.

Table 3.7-10 Potential Presence of Protected Trees by Subsection

Resource	San Jose Diridon Station Approach	Monterey Corridor	Morgan Hill and Gilroy	Pacheco Pass	San Joaquin Valley
Blue oak–foothill pine woodland	–	–	–	Yes	–
California sycamore woodland	–	–	–	Yes	–
Coast oak woodland	–	–	Yes	Yes	–
Mixed chaparral	–	–	Yes	Yes	–
Mixed riparian	Yes	–	Yes	Yes	Yes
Ornamental woodland	Yes	Yes	Yes	Yes	Yes
Palustrine forested wetland	Yes	–	Yes	Yes	Yes
Urban landscaping	Yes	Yes	Yes	–	–

Wildlife Movement

The project extent crosses several wildlife corridors of regional importance. Although corridors occur in all subsections, those in the Santa Clara Valley (specifically, the Coyote Valley, Soap Lake, and Pacheco Pass), the western Pacheco Pass region, and San Joaquin Valley (GEA) have been identified by the CDFW and local stakeholders as particularly important to wildlife movement and habitat connectivity at the regional and state scale. Further details on existing wildlife corridors within the regional RSA are provided in Chapter 5 of the WCA (Appendix C of the Biological and Aquatic Resources Technical Report [Authority 2020a).).



OCTOBER 2021

Figure 3.7-4 Wildlife Corridors within the Regional RSA

As described previously, the mountain lion was recently added as a candidate for listing under CESA, and the monarch butterfly became a candidate for listing under FESA in December 2020. Substantial impacts on monarch movement are unlikely to occur because of the species' large range, migration patterns, and density of occurrence in the project vicinity. However, movement within the project area is very important to the mountain lion population in the region, and, although the mountain lion was not a candidate for listing under CESA at the time the WCA was prepared, the WCA included an analysis of movement effects on mountain lion as a focal species (the single member of the "high openness and high mobility species guild"). As described in detail in the WCA, existing information on mountain lion movement was considered and incorporated into the assessment. Extensive information was used in the development of the WCA; major sources of information included:

- *Coyote Valley Linkage Assessment Study* (Diamond and Snyder 2016)
- *The Nature Conservancy's Pajaro Study 2012–2013* (Diamond and Snyder 2013)
- *Wildlife Permeability and Hazards across Highway 152 Pacheco Pass: Establishing a Baseline to Inform Infrastructure and Restoration* (Pathways for Wildlife 2020)
- Mountain lion GPS collar tracking data (Wilmers 2017)
- Wildlife–vehicle collision records (CROS 2017; Road Ecology Center 2017; Diamond 2017; Hobbs 2017; Constable et al. 2009)

The WCA synthesized existing information, and quantitative GIS-based modeling methods were used to evaluate the changes in wildlife movement that would result from project construction. The methods used were adapted from similar analytic efforts conducted by other wildlife movement experts in the region (i.e., Penrod et al. 2013). The quantitative results of the analysis were evaluated using criteria to discern where permeability reductions would be likely to have an effect on the movement of focal species. Where moderate or high potential effects were identified, recommendations to facilitate wildlife movement were made in the WCA and were subsequently incorporated into the proposed project to the extent feasible.[6] Recommendations included minimum and recommended crossing dimensions for mountain lion (and other species), as well as recommended design features and other measures to facilitate use by focal species. In summary, although the mountain lion was not a candidate for listing at the time the WCA was prepared, the WCA specifically addressed it and assessed movement effects on mountain lion as a focal species, and that analysis remains relevant and sufficient now that the species is a state candidate for listing. However, additional analyses of noise and artificial lighting impacts on wildlife, including the mountain lion, were undertaken as part of the Revised/Supplemental Draft EIR/EIS and are included in this Final EIR/EIS as Appendix 3.7-E and Appendix 3.7-F (as it is relevant to the overall mountain lion analysis revision in response to its designation as a candidate species).

Additionally, CDFW provided additional information (a map illustrating roadkill data and other information) in their comments on the Revised/Supplemental Draft EIR/EIS. The information generally supports the findings in the WCA that mountain lions are attempting to move across SR 152; however, they are being struck and killed by vehicles in the region. The information generally supports the need for better wildlife undercrossings or overcrossings in the region to prevent vehicle fatalities.

The additional noise analysis in Appendix 3.7-E indicates that, along much of the alignment, noise exposures from the project would be reduced due to masking effects. Masking effects would occur in areas where a competing noise source (vehicular traffic, usually associated with a major highway or an urban core area) would mask the noise of the HSR trains. As noted in Appendix 3.7-E, the entire project extent located north of Station B665+00 is located in the San Jose urban area, with numerous arterial roads that support traffic much of the day, and the alignment is also collocated with Caltrain and freight rail traffic. Therefore, noise generated by HSR would be masked on both

[6] The WCA, Section 7.2.2, noted that additional dedicated wildlife underpasses, not included in the project design, should be considered in the eastern Pacheco Pass area near Casa de Fruta.

sides of the project alignment through much of the day. Southwards, to approximately Station B1025+00, the project is still collocated with Caltrain and freight rail. Immediately to the east is arterial traffic on Monterey Road, and approximately 1 mile farther east is U.S. Highway 101, a major freeway. Thus, noise impacts are partially masked between the alignment and Coyote Creek and are substantially masked east of U.S. Highway 101; however, there are few and minor masking features west of the alignment, except that some topographic masking would occur in areas west of the valley floor. Continuing south, urban area masking would occur through the cities of Morgan Hill and Gilroy, down to Station B1730+00 where the rail alignment intersects U.S. Highway 101. South of there, however, the line turns east and transits open agricultural lands across the valley floor to about Station B2250+00; throughout this area, there are no major sources of masking noise on the landscape. Eastward to Station B2350+00, the alignment crosses SR 152, then passes through a tunnel, and then crosses SR 152 again. The busy highway would provide some masking effect to reduce noise effects in the hills north of SR 152, while the tunnel would mask all train noise. From Station B2350+00 to B3330+00, the alignment would follow the valley of Pacheco Creek. Throughout this area, SR 152 is never more than 0.5 mile north of the alignment, and it would provide substantial masking in that direction. To the south, however, there are no sources of masking noise, except that some topographic masking would occur in areas on the slopes west of Pacheco Peak. From Station B3330+00 to Station B4030+00, the alignment is in a tunnel, and noise effects on wildlife would not be a concern. East from there to Volta, Station B4630+00, the alignment traverses rural and agricultural lands with little masking except locally where the alignment crosses I-5 at nearly a perpendicular angle. From Volta to the project's eastern limit at Station B5330+00, however, the alignment traverses agricultural and wildlife lands on the south side of Henry Miller Road, a moderately busy arterial, which provides some masking for lands north of the alignment but no masking for lands south of the alignment. Additional information regarding existing conditions and the noise analysis is located in Appendix 3.7-E.

The artificial lighting analysis in Appendix 3.7-F provides background on ALAN, which is defined for the proposed project as all exterior artificial light sources used during construction and operations to light the site, as well as vehicle-mounted lighting. The additional analysis of lighting impacts in Appendix 3.7-F indicates that the region generally has a high level of existing light exposure from San Jose to the southern outskirts of Gilroy (with appreciably lower levels in the Coyote Valley area). South and east of Gilroy, ALAN levels are generally low throughout most of the remaining alignment. The analysis focuses on three forms of project-related ALAN: continuous lighting directed onto the project site that is visible to wildlife located outside the project site, intermittent lighting from vehicle or train headlights that is directed toward wildlife habitat, and lighting from all project sources that contributes to skyglow. No research appears to have assessed the effects of light from high-speed trains in other countries or locations.

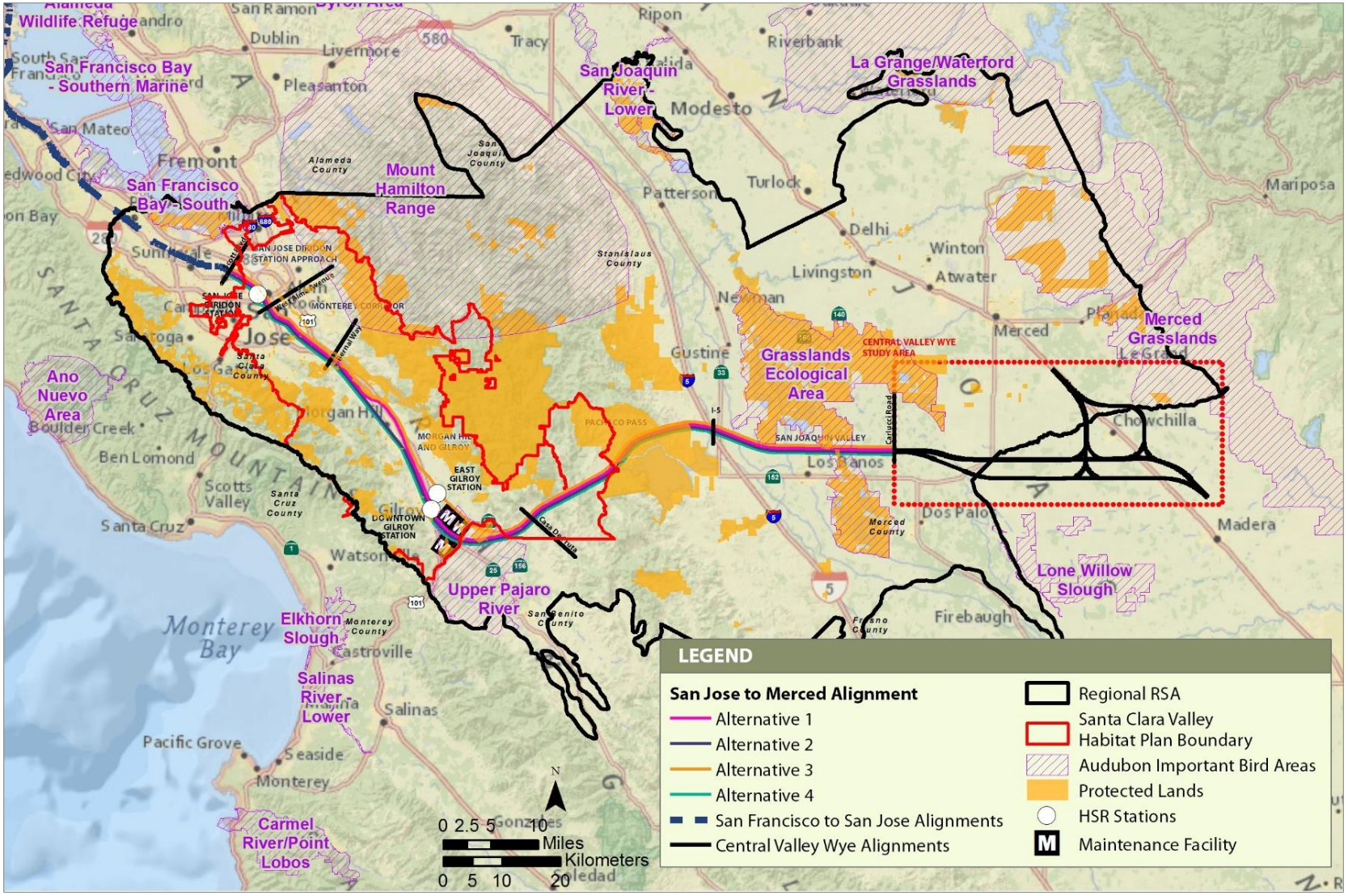
Conservation Areas

This section identifies conservation areas that could potentially be affected by the project. Conservation areas include public lands (refuges and ecological reserves), conservation easements, and conservation and mitigation banks (Table 3.7-11 and Figure 3.7-5).

Table 3.7-11 Conservation Areas by Subsection[1]

Conservation Area Name	Owner/Manager/Easement Holder
San Jose Diridon Station Approach	
Guadalupe River Park and Gardens	City of San Jose
Morgan Hill and Gilroy	
Bloomfield (North and South)[2, 3]	Santa Clara Valley Open Space Authority
Coyote Creek Parkway	Santa Clara—Parks and Recreation Department
Fisher Creek Conservation Easement	Silicon Valley Land Conservancy
Halperin Conservation Easement[3]	Santa Clara Valley Open Space Authority
Pajaro Ranch[3]	The Nature Conservancy
Pajaro River Agricultural Preserve	Santa Clara Valley Open Space Authority
Pajaro River Mitigation Bank	Wildlands, Inc.
Soap Lake Ranch Easement[3]	San Benito Agricultural Trust
Silveira	Santa Clara—Parks and Recreation Department
Tulare Hill Land Bank	Santa Clara—Parks and Recreation Department
Tulare Hill Wedge Open Space Regional Reserve	Santa Clara Valley Habitat Agency
Tulare Meadows	Santa Clara Valley Open Space Authority
Pacheco Pass	
Cottonwood Creek Wildlife Area	California Department of Fish and Wildlife
Pacheco Creek Open Space Regional Reserve	Santa Clara Valley Habitat Agency
Romero Ranch Conservation Easement	The Nature Conservancy
Sequoia Riverlands Trust Conservation Easement	Sequoia Riverlands Trust
San Joaquin Valley	
Mud Slough Conservation Easement	California Department of Fish and Wildlife

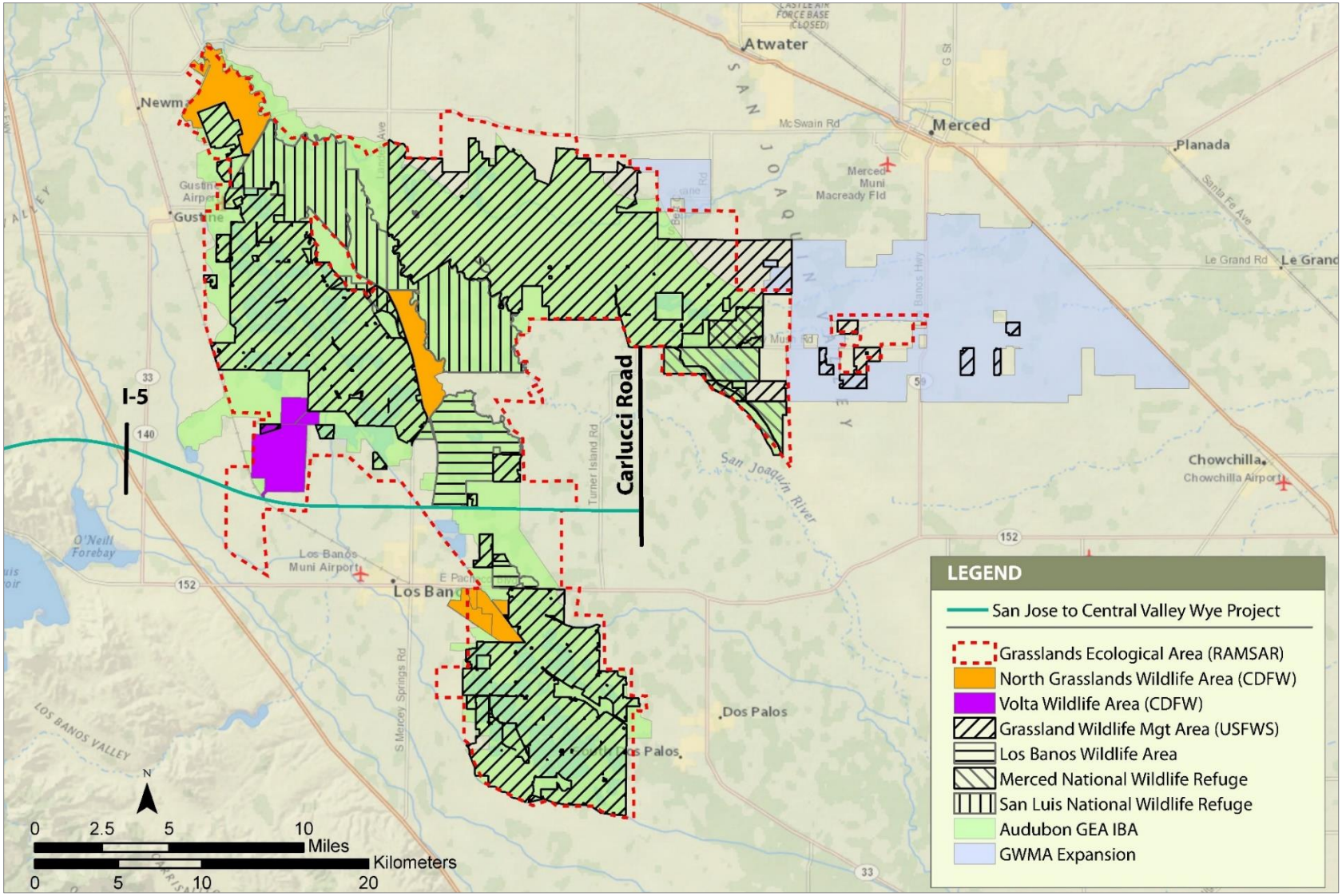
Source: GreenInfo Network 2016a
GEA = Grasslands Ecological Area
[1] The GEA is a broadly defined region which encompasses a portion of the project area. Specific conservation areas (i.e., easements, mitigation banks, etc.), some of which overlap with the GEA, are listed individually, however the GEA is not listed in this table.
[2] Bloomfield was referred to as "Silacci" in the Draft EIR/EIS; however, the name has been corrected.
[3] Several properties were collectively referred to as the "Soap Lake Properties" in the Draft EIR/EIS but have now been listed individually.



Sources: GreenInfo Network 2016a, 2016b

JANUARY 2019

Figure 3.7-5 Protected Lands and Conservation Planning Boundaries in the Regional RSA



Note: RAMSAR = Ramsar Convention on Wetlands of International Importance; CDFW = California Department of Fish and Wildlife; USFWS = U.S. Fish and Wildlife Service; GEA = Grasslands Ecological Area; IBA = Important Bird Area; GWMA = Grasslands Wildlife Management Area
Sources: Ramsar 2005; USFWS 2020

NOVEMBER 2020

Figure 3.7-6 Area of Conservation Significance in the San Joaquin Valley

Conservation Easements

Four conservation easements were identified in the habitat study area (Table 3.7-11). Of these, the Romero Ranch conservation easement, held by The Nature Conservancy, is the most substantial in the habitat study area. In total, this easement occupies nearly 29,000 acres in western Merced County.

Public Lands

Numerous properties, shown in Table 3.7-11, were identified. While not strictly or necessarily open to the public, these lands are generally held by local governments, open space authorities, or conservation organizations for the purposes of preserving and protecting biological resources or open space.

The GEA is the primary geographic area of conservation significance in the San Joaquin Valley portion of the habitat study area (Figure 3.7-6). It is a 160,000-acre mosaic of freshwater wetlands, alkali grassland, and riparian thickets cooperatively managed by a variety of private, state, and federal landowners, including USFWS (San Luis and Merced National Wildlife Refuges, Grasslands Wildlife Management Area), CDFW (Volta, Los Banos, and North Grasslands Wildlife Areas), California State Parks (Great Valley Grasslands State Park), and private duck clubs. The GEA is an "administrative" boundary, first outlined as an area of conservation significance in the Ramsar Convention on Wetlands of International Importance, signed in 1971. Within this area, agencies and landowners cooperatively seek the protection and enhancement of habitat for large concentrations of birds. Although it is not subject to any regional HCPs, a portion of the GEA has been identified as an Audubon IBA (National Audubon Society 2017a) and a Site of International Importance by the Western Hemisphere Shorebird Reserve Network (WHSRN 2017) because it is located within the Pacific Flyway and seasonally supports nearly 50 percent of all Central Valley shorebirds during the peak of spring migration (mid-April) and a half-million individual ducks, geese, and swans each year between November and February (National Audubon Society 2017a). The project extent passes through the GEA in two locations where it parallels Henry Miller Avenue between CDFW's Volta and Los Banos Wildlife Areas. Although there is significant overlap between the Audubon GEA IBA and the overall administrative boundary of the GEA, the extent of the GEA and Audubon IBA boundaries within the project extent is slightly different, as depicted on Figure 3.7-6.

Conservation/Mitigation Banks

Only one conservation or mitigation bank, the Pajaro River Mitigation Bank, was identified in the habitat study area. It is managed by Wildlands, Inc. and provides credits for jurisdictional wetlands and waters.

Habitat Conservation Plans

The Santa Clara Valley is the subject of three HCPs: the SCVHP (Figure 3.7-5), implemented by the Santa Clara Valley Habitat Agency (SCVHA), the Greenprint, developed by the SCVOSA (SCVOSA 2014), and the *Coyote Valley Landscape Linkage* report, also developed by the SCVOSA (2017). A key component of the SCVHP and Greenprint is the protection and management of serpentine habitat along Coyote Ridge that has also been deemed by the USFWS as essential for the recovery of Bay checkerspot butterfly and other serpentine species in its *Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area* (USFWS 1998). Both plans also emphasize the protection, enhancement, and restoration of aquatic habitat for California tiger salamander, California red-legged frog, western pond turtle, and foothill yellow-legged frog in the foothills on either side of the valley, and open lands on the valley floor and adjacent foothills that provide habitat for burrowing owl. The SCVHP also covers most Santa Clara County lands in the Diablo Range portion of the habitat study area (i.e., from the headwaters of the East and Middle Forks of Coyote Creek south to the county line), including resources associated with Pacheco Creek and its tributaries (e.g., habitat linkages, California sycamore woodland, species habitat). The *Coyote Valley Landscape Linkage* report recommends specific actions to improve wildlife movement across Coyote Valley. Recommendations include

enhancements to existing crossings (e.g., Fisher Creek), new crossings (culverts and overpasses), conservation of land, and additional research.

3.7.7 Environmental Consequences

3.7.7.1 Overview

This section discusses the potential impacts on biological and aquatic resources that could result from construction and operations of the project alternatives. The impacts are organized into the following categories:

- Special-status species (plants and animals)
- Non-special-status species (common plants and animals)
- Special-status plant communities
- Jurisdictional aquatic resources (e.g., wetlands)
- Protected trees
- Wildlife movement
- Conservation areas (preserves, conservation easements, and mitigation banks)
- HCPs

Construction and operation of the project could result in temporary and permanent construction impacts as well as intermittent operations impacts on special-status species. Construction and operations impacts on special-status plant and wildlife species could include the direct removal of habitat (i.e., areas known or likely to contain the physical and biological conditions required to support occupancy by individuals or populations of special-status species; see text box in Section 3.7.5.3), mortality or removal of individuals, and modification and fragmentation of habitats. Temporary construction impacts could result from grading, construction of staging areas, temporary roadways, and cut-and-fill slopes. Intermittent operations impacts on special-status species could result from noise, lighting, and maintenance of the HSR right-of-way. The project would also have impacts on critical habitat, designated by USFWS for California tiger salamander, California red-legged frog, and Bay checkerspot butterfly, and by NMFS for steelhead.

Through similar mechanisms, construction and operations of the project could result in temporary and permanent construction impacts as well as intermittent operations impacts on non-special-status wildlife (i.e., common wildlife species), special-status plant communities, jurisdictional aquatic resources, protected trees, wildlife movement, conservation areas, and adopted HCPs.

Indirect impacts (e.g., modification of hydrology, introduction of invasive nonnative species) were not quantified for this analysis. However, indirect impacts were assumed to roughly scale with the extent of direct impacts because for this linear project, alternatives with greater amounts of resources in the project footprint (e.g., special-status species habitat, aquatic resources under regulatory jurisdiction) would also potentially abut greater amounts of such resources adjacent to the footprint.

3.7.7.2 Special-Status Species

No Project Impacts

The population in the regional RSA is expected to grow through 2040 (see Section 2.6.1.1, Projections Used in Planning). Development in the region to accommodate the population increase would continue under the No Project Alternative, resulting in associated direct and indirect impacts on biological and aquatic resources. Such planned projects that are anticipated to be constructed by 2040 include residential, commercial, industrial, recreational, transportation, energy, and agricultural projects. The No Project Alternative considers the impacts of conditions forecast by current plans for land use and transportation in the vicinity of the project extent, including planned improvements to the highway, aviation, conventional passenger rail, freight rail, and port systems through the 2040 planning horizon for the environmental analysis if the proposed project is not built. With no project, there would be a greater amount of vehicle miles

traveled (VMT), resulting in increased pressure to improve capacity for all transportation modes throughout the area. The Authority estimates that additional highway and airport projects (up to 4,300 highway lane miles, 115 airport gates, and 4 airport runways) would be planned and constructed to achieve equivalent capacity and relieve this increased pressure (Authority 2012a).

Future development projects in are detailed in in Volume 2, Appendix 3.19-A, Nontransportation Plans and Projects, and Appendix 3.19-B, Transportation Plans and Projects. Under the No Project Alternative, recent development trends are anticipated to continue, leading to impacts on special-status species. Future changes in land use or allowable density of development, as well as ground disturbance associated with future infrastructure improvements such as highway expansions to accommodate population growth, would have impacts on special-status species similar to those that have resulted from past development, such as habitat loss, degradation, and fragmentation; potential mortality of individuals and populations of special-status plant and wildlife species; and possible extirpation events.

Project Impacts

Construction and operations of the project would result in permanent and temporary impacts on land cover potentially suitable as habitat for special-status plant and wildlife species, including state and federally listed species. All aspects of construction and operations have the potential to cause impacts, either from direct removal of habitat or individuals, or from indirect impacts such as introduction of nonnative invasive species or changes in hydrology. Construction impacts on special-status plant species are presented first, followed by construction impacts on special-status wildlife species, then operations impacts on special-status plant species and special-status wildlife species. Table 3.7-12 and Table 3.7-13 show the extent of impacts on special-status plants and wildlife, respectively, by alternative. Table 3.7-14 shows the extent of impacts on designated critical habitat.

Construction Impacts

Impact BIO#1: Permanent Conversion or Degradation of Habitat for Special-Status Plant Species

Effects Other than Potential Tunnel Construction Effects on Groundwater Levels
Construction of the HSR track and systems in all subsections would take place in land cover types that could support special-status plant species, including species listed under FESA and CESA (with the exception of the San Jose Diridon Station Approach Subsection, which only supports habitat for nonlisted special-status species). Such activities would convert and disturb habitat and could result in the removal of special-status plant occurrences. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without habitat for special-status species and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources..

Table 3.7-12 Impacts on Habitat for Special-Status Plant Species by Project Alternative (acres)

Impacts	Alt 1			Alt 2			Alt 3			Alt 4		
	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total
Alkali milkvetch	39.2	38.9	78.1	39.2	38.9	78.1	39.2	38.9	78.1	39.2	38.9	78.1
Bent-flowered fiddleneck	340.5	87.1	427.6	340.5	87.1	427.6	340.5	87.0	427.5	340.5	87.1	427.6
Big-scale balsamroot	0.0	6.9	6.9	0.0	6.9	6.9	0.0	6.9	6.9	0.0	6.8	6.8
Brittlescale	28.3	32.8	61.1	28.3	32.8	61.1	28.3	32.8	61.1	28.3	32.8	61.1
California alkali grass	200.7	101.7	302.4	200.4	101.6	302.0	207.5	102.8	310.3	195.6	98.7	294.3
Caper-fruited tropidocarpum[1]	776.0	366.0	1,142.0	781.2	388.7	1,169.9	777.0	370.5	1,147.5	752.5	342.8	1,095.3
Chaparral ragwort[1]	244.8	102.8	347.6	244.8	102.8	347.6	244.8	102.8	347.6	244.8	102.8	347.6
Colusa grass	1.5	0.5	2.0	1.5	0.5	2.0	1.5	0.5	2.0	1.5	0.5	2.0
Congdon's tarplant	17.0	8.2	25.2	17.7	10.2	27.9	17.7	8.4	26.1	15.9	8.4	24.3
Coulter's goldfields	0.8	0.2	1.0	0.8	0.2	1.0	0.8	0.2	1.0	0.8	0.2	1.0
Coyote ceanothus	3.5	18.1	21.6	8.7	21.5	30.2	3.5	18.1	21.6	1.5	15.8	17.3
Delta button-celery	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.2
Fragrant fritillary[1]	85.1	118.9	204.0	91.9	143.8	235.7	86.1	123.6	209.7	64.9	95.2	160.1
Hairless popcornflower	8.6	3.5	12.1	8.6	3.5	12.1	10.0	0.1	10.1	6.8	1.2	8.0
Hall's bush-mallow	15.9	4.6	20.5	17.6	6.7	24.3	15.9	4.4	20.3	19.2	3.9	23.1
Heartscale	0.8	0.2	1.0	0.8	0.2	1.0	0.8	0.2	1.0	0.8	0.2	1.0
Hispid salty bird's-beak[1]	762.0	358.8	1,120.8	767.2	382.0	1,149.2	764.4	360.1	1,124.5	736.6	333.4	1,070.0
Hoover's button-celery	3.3	0.6	3.9	2.7	0.5	3.2	0.9	6.0	6.9	2.7	0.0	2.7
Hoover's cryptantha[1]	243.8	124.1	367.9	243.8	124.1	367.9	243.8	124.1	367.9	243.8	124.1	367.9
Hoover's spurge	1.5	0.5	2.0	1.5	0.5	2.0	1.5	0.5	2.0	1.5	0.5	2.0
Hospital Canyon larkspur	135.2	13.7	148.9	135.2	13.7	148.9	135.2	13.7	148.9	135.2	13.7	148.9
Indian Valley bush-mallow	0.0	0.2	0.2	0.6	0.9	1.5	0.0	0.2	0.2	0.6	<0.1	0.6

Impacts	Alt 1			Alt 2			Alt 3			Alt 4		
	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total
Legenere	7.6	1.9	9.5	7.0	1.9	8.9	14.0	7.4	21.4	7.1	1.3	8.4
Lemmon's jewelflower[1]	310.6	119.4	430.0	310.6	119.4	430.0	310.6	119.4	430.0	310.6	119.4	430.0
Lesser saltscale	0.8	0.2	1.0	0.8	0.2	1.0	0.8	0.2	1.0	0.8	0.2	1.0
Little mousetail	38.1	38.2	76.3	38.1	38.2	76.3	38.1	38.2	76.3	38.1	38.2	76.3
Loma Prieta hoita	7.9	18.9	26.8	8.2	20.6	28.8	10.1	21.6	31.7	5.0	14.4	19.4
Lost Hills crownscale[1]	313.8	123.1	436.9	313.8	123.1	436.9	313.8	123.1	436.9	313.8	123.1	436.9
Metcalf Canyon jewelflower	10.2	23.8	34.0	15.1	29.0	44.1	10.2	23.8	34.0	11.3	15.8	27.1
Most beautiful jewelflower	3.5	18.0	21.5	8.3	21.5	29.8	3.5	18.0	21.5	1.3	15.7	17.0
Mount Diablo cottonweed	0.0	14.8	14.8	0.0	14.8	14.8	0.0	14.9	14.9	0.0	14.8	14.8
Mount Hamilton fountain thistle	33.2	27.2	60.4	38.2	30.7	68.9	33.2	27.2	60.4	31.0	24.9	55.9
Palmate-bracted bird's-beak	9.2	3.8	13.0	9.2	3.8	13.0	9.2	3.8	13.0	9.2	3.8	13.0
Pink creamsacs	0.0	14.8	14.8	0.0	14.8	14.8	0.0	14.9	14.9	0.0	14.8	14.8
Prostrate vernal pool navarretia	9.9	2.7	12.6	9.3	2.7	12.0	7.4	8.1	15.5	9.3	2.2	11.5
Recurved larkspur[1]	216.2	120.8	337.0	216.2	120.8	337.0	216.2	120.8	337.0	216.2	120.8	337.0
Robust spineflower	0.0	<0.1	0.0	0.0	<0.1	0.0	0.0	<0.1	0.0	0.0	0.0	0.0
Round-leaved filaree[1]	722.3	305.4	1,027.7	726.8	326.1	1,052.9	722.6	309.6	1,032.2	699.9	282.1	982.0
Saline clover	37.0	40.0	77.0	41.5	44.2	85.7	41.7	49.2	90.9	33.4	37.7	71.1
San Antonio Hills monardella	0.2	0.1	0.3	0.2	0.1	0.3	0.2	0.1	0.3	0.2	0.1	0.3
San Francisco collinsia	17.0	30.6	47.6	17.7	32.6	50.3	17.7	30.9	48.6	15.9	30.7	46.6
San Joaquin spearscale[1]	75.9	78.3	154.2	80.7	82.5	163.2	84.4	79.6	164.0	71.0	74.3	145.3
Sanford's arrowhead	16.5	13.4	29.9	16.5	13.4	29.9	16.5	13.4	29.9	16.5	13.4	29.9
Santa Clara Valley dudleya	9.8	20.7	30.5	14.7	25.5	40.2	9.8	20.7	30.5	10.9	12.7	23.6
Shining navarretia[1]	244.8	102.8	347.6	244.8	102.8	347.6	244.8	102.8	347.6	244.8	102.8	347.6
Showy golden madia[1]	585.2	189.7	774.9	585.2	189.7	774.9	585.2	189.6	774.8	585.2	189.7	774.9

Impacts	Alt 1			Alt 2			Alt 3			Alt 4		
	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total
Slender-leaved pondweed	<0.1	<0.1	0.0	<0.1	<0.1	0.0	<0.1	<0.1	0.0	<0.1	<0.1	0.0
Smooth lessingia	33.2	27.2	60.4	38.0	30.6	68.6	33.2	27.2	60.4	31.0	24.9	55.9
Tiburon Paintbrush	3.5	18.1	21.6	8.5	21.5	30.0	3.5	18.1	21.6	1.3	15.7	17.0
Two-fork clover	0.0	14.8	14.8	0.0	14.8	14.8	0.0	14.9	14.9	0.0	14.8	14.8
Vernal barley	2.1	0.6	2.7	2.1	0.6	2.7	2.1	0.6	2.7	2.1	0.6	2.7
Vernal pool smallscale	1.5	0.5	2.0	1.5	0.5	2.0	1.5	0.5	2.0	1.5	0.5	2.0
Woodland woollythreads[1]	725.8	222.7	948.5	731.4	237.1	968.5	725.5	223.2	948.7	703.2	202.1	905.3
Woolly-headed lessingia[1]	70.9	114.3	185.2	75.9	135.6	211.5	71.9	122.0	193.9	48.5	91.1	139.6
Wright's trichocoronis	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.2
Total All Species	**6,415.4**	**3,095.3**	**9,510.7**	**6,493.5**	**3,266.4**	**9,759.9**	**6,447.3**	**3,145.8**	**9,593.1**	**6,252.0**	**2,909.8**	**9,161.8**
Total All Species Habitat Affected (Nonoverlapping)	**1,179.3**	**460.1**	**1,639.4**	**1,185.9**	**487.1**	**1,673.0**	**1,190.8**	**467.5**	**1,658.3**	**1,154.2**	**429.1**	**1,583.3**

Nonoverlapping acreage reflects the *aggregate* areal extent of all species taken together—in other words, the exterior perimeter of the overlapping boundaries of mapped habitat, so that land where habitat has been mapped for more than one species is present, it is only counted once.

[1] Estimated impacts are high because species occurs in land cover type(s) that are abundant throughout the special-status plant study area (e.g., California annual grassland, coastal oak woodland). The actual likelihood of encountering these rare species during botanical field surveys prior to construction is low and the likelihood of direct impacts is even lower because such occurrences may be avoided by construction.

Table 3.7-13 Direct Impacts on Special-Status Wildlife Species Habitat by Project Alternative (acres)

Impacts	Alt 1			Alt 2			Alt 3			Alt 4		
	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total
Bay Checkerspot Butterfly												
Suitable habitat	9.8	22.6	32.4	14.7	27.8	42.5	9.8	22.6	32.4	10.9	14.5	25.4
Monarch Butterfly												
Breeding/migration habitat	3,844.8	1,501.0	5,345.8	3,902.8	1,704.0	5,606.8	3,999.4	1,549.4	5,548.8	3,677.2	1,415.1	5,092.3
Vernal Pool Crustaceans												
Vernal pool fairy shrimp	27.6	0.0	27.6	0.5	0.0	27.6	27.6	0.0	27.6	27.6	0.0	27.6
Vernal pool tadpole shrimp	27.6	0.0	27.6	0.5	0.0	27.6	27.6	0.0	27.6	27.6	0.0	27.6
Longhorn fairy shrimp	0.5	0.0	0.5	0.5	0.0	0.5	0.5	0.0	0.5	0.5	0.0	0.5
Conservancy fairy shrimp	0.5	0.0	0.5	0.5	0.0	0.5	0.5	0.0	0.5	0.5	0.0	0.5
Nonoverlapping total habitat	27.6	0.0	27.6	27.6	0.0	27.6	27.6	0.0	27.6	27.6	0.0	27.6
Valley Elderberry Longhorn Beetle												
Potentially suitable riparian habitat	1.0	0.4	1.4	1.0	0.4	1.4	1.0	0.4	1.4	1.0	0.4	1.4
Other potentially suitable habitat	101.6	55.9	157.5	101.6	55.9	157.5	101.6	55.9	157.5	101.6	55.9	157.5
Total	102.6	56.3	**158.9**	102.6	56.3	**158.9**	102.6	56.3	**158.9**	102.6	56.3	**158.9**
Crotch Bumble Bee												
Suitable Habitat	1,147.2	436.4	1,583.6	1,154.5	461.8	1,616.3	1,148.8	444.0	1,592.8	1,127.0	412.7	1,539.7
Total	1,147.2	436.4	**1,583.6**	1,154.5	461.8	**1,616.3**	1,148.8	444.0	**1,592.8**	1,127.0	412.7	**1,539.7**
Special-Status Fish Species												
Steelhead—central California coast/south-central California coast DPS	19.9	14.1	34.0	21.6	14.5	36.1	31.5	15.3	46.8	19.3	11.8	31.1
Pacific Coast salmon EFH	3.3	6.5	9.8	1.5	8.7	10.2	3.3	6.5	9.8	2.3	4.3	6.6
Pacific lamprey	138.8	68.6	207.4	141.6	71.5	213.1	147.4	65.2	212.6	138.3	62.2	200.5
Nonoverlapping total habitat	157.3	82.9	240.2	159.4	88.2	247.6	177.4	80.6	258.0	154.9	73.4	228.3

Impacts	Alt 1			Alt 2			Alt 3			Alt 4		
	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total
California Tiger Salamander												
Breeding and foraging aquatic habitat	52.5	61.8	114.3	57.1	63.7	120.8	47.3	60.8	108.1	37.0	56.0	93.0
Subtotal Aquatic Habitat	52.5	61.8	114.3	57.1	63.7	120.8	47.3	60.8	108.1	37.0	56.0	93.0
Potential agricultural refugia and dispersal habitat	1,068.1	436.4	1,504.5	1,101.8	585.5	1,687.3	1,258.0	477.0	1,735.0	969.1	388.5	1,357.6
Refugia and dispersal upland habitat	1,128.5	412.4	1,540.9	1,146.2	438.4	1,584.6	1,142.5	418.7	1,561.2	1,120.3	397.7	1,518.0
Subtotal upland/dispersal habitat	2,196.6	848.8	3,045.4	2,248.0	1,023.9	3,271.9	2,400.5	895.7	3,296.2	2,089.4	786.2	2,875.6
Total	2,249.1	910.6	**3,159.7**	2,305.1	1,087.6	**3,392.7**	2,447.8	956.5	**3,404.3**	2,126.4	842.2	**2,968.6**
California Red-Legged Frog												
Breeding season aquatic habitat	85.6	42.6	128.2	90.0	45.9	135.9	81.5	37.5	119.0	72.8	31.0	103.8
Subtotal breeding habitat	85.6	42.6	128.2	90.0	45.9	135.9	81.5	37.5	119.0	72.8	31.0	103.8
Refugia/foraging habitat	507.1	169.5	676.6	519.7	197.3	717.0	499.3	160.7	660.0	494.9	160.0	654.9
Dispersal/seasonal movement habitat	991.5	319.7	1,311.2	1,016.6	437.5	1,454.1	1,046.5	347.9	1,394.4	858.3	276.2	1,134.5
Other potential movement habitat	86.4	53.5	139.9	89.0	81.3	170.3	182.9	75.6	258.5	70.6	32.3	102.9
Permeable movement area (dev, ag, disturbed)	319.8	261.9	581.7	444.7	411.5	856.2	309.1	260.6	569.7	315.9	157.7	473.6
Subtotal nonbreeding habitat	1,904.8	804.6	2,709.4	2,070.0	1,127.6	3,197.6	2,037.8	844.8	2,882.6	1,739.7	626.2	2,365.9
Total	1,990.4	847.2	**2,837.6**	2,160.0	1,173.5	**3,333.5**	2,119.3	882.3	**3,001.6**	1,812.5	657.2	**2,469.7**
Foothill Yellow-Legged Frog												
Primary breeding and foraging habitat	44.4	19.1	63.5	44.4	19.1	63.5	44.4	19.1	63.5	44.4	19.1	63.5
Secondary breeding and foraging habitat	47.3	22.2	69.5	44.8	22.9	67.7	47.5	21.9	69.4	43.9	20.3	64.2
Total	91.7	41.3	**133.0**	89.2	42.0	**131.2**	91.9	41.0	**132.9**	88.3	39.4	**127.7**

Impacts	Alt 1			Alt 2			Alt 3			Alt 4		
	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total
Western Spadefoot												
Aquatic breeding habitat	13.9	44.0	57.9	13.9	44.0	57.9	22.4	42.8	65.2	13.9	44.0	57.9
Vernal pool complex, breeding, cover, and aestivation	22.0	28.7	50.7	22.0	28.7	50.7	22.0	28.7	50.7	22.0	28.7	50.7
Subtotal breeding habitat	35.9	72.7	108.6	35.9	72.7	108.6	44.4	71.5	115.9	35.9	72.7	108.6
Terrestrial cover and aestivation habitat	492.8	139.4	632.2	492.8	139.4	632.2	501.8	143.2	645.0	492.8	139.4	632.2
Subtotal nonbreeding habitat	492.8	139.4	632.2	492.8	139.4	632.2	501.8	143.2	645.0	492.8	139.4	632.2
Total	528.7	212.1	**740.8**	528.7	212.1	**740.8**	546.2	214.7	**760.9**	528.7	212.1	**740.8**
Western Pond Turtle												
Potentially suitable foraging and basking habitat	97.3	90.7	188.0	105.4	94.3	199.7	93.6	88.0	181.6	82.2	83.3	165.5
Potentially suitable primary nesting and overwintering habitat	2,002.8	956.9	2,959.7	2,118.6	1,113.0	3,231.6	1,967.6	931.0	2,898.6	1,947.7	820.1	2,767.8
Potentially suitable secondary nesting and movement habitat	510.5	242.8	753.3	582.3	374.6	956.9	484.2	247.1	731.3	431.7	152.2	583.9
Total	2,610.6	1,290.4	**3,901.0**	2,806.3	1,581.9	**4,388.2**	2,545.4	1,266.1	**3,811.5**	2,461.6	1,055.6	**3,517.2**
Blunt-Nosed Leopard Lizard												
Core suitable habitat	270.7	96.9	367.6	270.7	96.9	367.6	270.7	96.9	367.6	270.7	96.9	367.6
Potentially suitable habitat	66.8	66.1	132.9	66.8	66.1	132.9	66.8	66.1	132.9	66.8	66.1	132.9
Atypical habitat	139.6	56.2	195.8	139.6	56.2	195.8	139.6	56.2	195.8	139.6	56.2	195.8
Total	477.1	219.2	**696.3**	477.1	219.2	**696.3**	477.1	219.2	**696.3**	477.1	219.2	**696.3**

Impacts	Alt 1			Alt 2			Alt 3			Alt 4		
	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total
San Joaquin Coachwhip, Northern California Legless Lizard, and Coast Horned Lizard												
San Joaquin coachwhip	632.0	223.9	855.9	632.0	223.9	855.9	632.0	223.8	855.8	632.0	223.9	855.9
Northern California legless lizard	15.9	3.9	19.8	15.9	3.9	19.8	15.9	3.8	19.7	15.9	3.9	19.8
Coast horned lizard	964.6	262.5	1,227.1	964.6	262.5	1,227.1	964.5	262.3	1,226.8	964.6	262.5	1,227.1
Nonoverlapping total habitat	992.9	279.7	1,272.6	992.9	279.7	1,272.6	992.9	279.5	1,272.4	992.9	279.7	1,272.6
Giant Garter Snake												
Potentially suitable aquatic habitat	25.6	18.2	43.8	25.6	18.2	43.8	25.6	18.2	43.8	25.6	18.2	43.8
Potentially suitable upland habitat	349.3	158.9	508.2	349.3	158.9	508.2	349.3	158.9	508.2	349.3	158.9	508.2
Potentially suitable movement habitat	10.5	5.5	16.0	10.5	5.5	16.0	10.5	5.5	16.0	10.5	5.5	16.0
Total	385.4	182.6	**568.0**	385.4	182.6	**568.0**	385.4	182.6	**568.0**	385.4	182.6	**568.0**
Short-Eared Owl and Grasshopper Sparrow												
Short-eared owl	352.5	162.4	514.9	352.5	162.4	514.9	352.5	162.4	514.9	352.5	162.4	514.9
Grasshopper sparrow	690.5	255.3	945.8	690.5	255.3	945.8	690.5	255.2	945.7	690.5	255.3	945.8
Nonoverlapping total habitat	1,043.1	417.7	1,460.8	1,043.1	417.7	1,460.8	1,043.0	417.6	1,460.6	1,043.1	417.7	1,460.8
Mountain Plover and Western Snowy Plover												
Mountain plover	593.2	314.4	907.6	593.2	314.4	907.6	593.2	314.4	907.6	593.2	314.4	907.6
Western snowy plover	20.3	14.8	35.1	20.3	14.8	35.1	20.3	14.8	35.1	20.3	14.8	35.1
Nonoverlapping total habitat	613.5	329.2	942.7	613.5	329.2	942.7	613.5	329.2	942.7	613.5	329.2	942.7

Impacts	Alt 1			Alt 2			Alt 3			Alt 4		
	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total
Burrowing Owl												
Occupied breeding and foraging habitat	3.1	0.0	3.1	7.7	1.4	9.1	3.1	0.0	3.1	0.7	0.0	0.7
Potential nesting and foraging habitat	1,028.8	469.4	1,498.2	1,132.5	624.0	1,756.5	1,180.7	506.9	1,687.6	954.4	384.0	1,338.4
Subtotal breeding habitat	1,031.9	469.4	1,501.3	1,140.2	625.4	1,765.6	1,183.8	506.9	1,690.7	955.1	384.0	1,339.1
Overwintering habitat	509.6	165.9	675.5	509.6	165.9	675.5	510.5	165.1	675.6	509.6	165.9	675.5
Subtotal overwintering habitat	509.6	165.9	675.5	509.6	165.9	675.5	510.5	165.1	675.6	509.6	165.9	675.5
Total	1,541.5	635.3	**2,176.8**	1,649.8	791.3	**2,441.1**	1,694.3	672.0	**2,366.3**	1,464.7	549.9	**2,014.6**
Golden Eagle and Bald Eagle												
Golden eagle												
Suitable nesting	348.6	61.9	410.5	349.1	62.5	411.6	349.2	65.1	414.3	348.6	62.0	410.6
Suitable foraging	776.0	366.0	1,142.0	781.2	388.7	1,169.9	777.0	370.5	1,147.5	752.5	342.8	1,095.3
Total	1,124.6	427.9	**1,552.5**	1,130.3	451.2	**1,581.5**	1,126.2	435.6	**1,561.8**	1,101.1	404.8	**1,505.9**
Bald eagle												
Suitable nesting	348.6	61.9	410.5	349.1	62.5	411.6	349.2	65.1	414.3	348.6	62.0	410.6
Suitable foraging	55.2	71.1	126.3	63.0	74.2	137.2	43.2	69.1	112.3	40.3	64.8	105.1
Total	403.8	133.0	**536.8**	412.1	136.7	**548.8**	392.4	134.2	**526.6**	388.9	126.8	**515.7**
Nonoverlapping total habitat	1,179.8	499.0	1,678.8	1,193.2	525.4	1,718.6	1,169.4	504.7	1,674.1	1,141.5	469.6	1,611.1
American Peregrine Falcon, Northern Harrier, and White-Tailed Kite												
American peregrine falcon	3,065.5	1,529.2	4,594.7	3,277.7	2,010.0	5,287.7	3,125.4	1,557.2	4,682.6	2,825.4	1,187.1	4,012.5
Northern harrier	1,697.0	784.1	2,481.1	1,805.3	946.0	2,751.3	1,851.3	823.7	2,675.0	1,618.5	738.1	2,356.6
White-tailed kite	2,299.3	919.1	3,218.4	2,356.8	1,121.7	3,478.5	2,444.9	968.0	3,412.9	2,136.5	835.4	2,971.9
Nonoverlapping total habitat	6,151.5	2,819.5	8,971.0	6,426.4	3,526.1	9,952.5	6,359.4	2,897.6	9,257.0	5,723.2	2,368.3	8,091.5

Impacts	Alt 1			Alt 2			Alt 3			Alt 4		
	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total
Swainson's Hawk												
Active nesting site	0.1	0.0	0.1	0.1	3.8	3.9	0.1	0.0	0.1	0.1	0.0	0.1
Inactive nesting site	25.6	43.8	69.4	25.6	43.8	69.4	25.6	43.8	69.4	25.6	43.8	69.4
Potential nesting habitat	8.1	4.2	12.3	8.1	4.2	12.3	8.1	4.2	12.3	8.1	4.2	12.3
Total nesting habitat	33.8	48.0	**81.8**	33.8	51.8	**85.6**	33.8	48.0	**81.8**	33.8	48.0	**81.8**
Primary active foraging habitat	303.7	141.0	444.7	322.8	162.9	485.7	303.7	141.0	444.7	316.8	141.0	457.8
Secondary active foraging habitat	493.4	294.4	787.8	522.9	350.8	873.7	493.4	294.4	787.8	485.9	282.5	768.4
Tertiary active foraging habitat	124.6	95.5	220.1	165.6	132.9	298.5	124.6	95.5	220.1	102.6	70.2	172.8
Total foraging habitat	921.7	530.9	**1,452.6**	1,011.3	646.6	**1,657.9**	921.7	530.9	**1,452.6**	905.3	493.7	**1,399.0**
Total foraging and nesting habitat	955.5	578.9	**1,534.4**	1,045.1	698.4	**1,743.5**	955.5	578.9	**1,534.4**	939.1	541.7	**1,480.8**
Loggerhead Shrike, Purple Martin and Olive-Sided Flycatcher												
Loggerhead shrike	2,334.3	941.5	3,275.8	2,391.7	1,144.1	3,535.8	2,478.7	993.0	3,471.7	2,171.5	857.7	3,029.2
Purple martin	371.0	72.8	443.8	371.0	72.8	443.8	370.9	71.1	442.0	371.0	72.8	443.8
Olive-sided flycatcher	386.9	76.7	463.6	386.9	76.7	463.6	386.8	74.9	461.7	386.9	76.7	463.6
Nonoverlapping total habitat	2,334.3	941.5	3,275.8	2,391.7	1,144.1	3,535.8	2,478.7	993.0	3,471.7	2,171.5	857.7	3,029.2
Least Bell's Vireo, Yellow Warbler, and Yellow-Breasted Chat												
Least Bell's vireo	67.7	51.6	119.3	70.1	54.4	124.5	70.1	50.6	120.7	62.4	42.9	105.3
Yellow warbler	31.3	22.9	54.2	31.1	24.0	55.1	32.8	20.7	53.5	27.9	17.4	45.3
Yellow-breasted chat	27.3	19.8	47.1	27.3	19.8	47.1	28.7	17.6	46.3	27.2	16.9	44.1
Nonoverlapping total habitat	126.2	94.3	220.5	128.5	98.1	226.6	131.6	88.9	220.5	117.5	77.2	194.7

Impacts	Alt 1			Alt 2			Alt 3			Alt 4		
	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total
Tricolored Blackbird and Yellow-Headed Blackbird												
Tricolored blackbird												
Previously occupied colony habitat	4.5	4.9	9.4	3.3	4.9	8.2	4.5	5.1	9.6	2.6	3.2	5.8
Potentially suitable colony habitat	74.7	83.2	157.9	80.9	85.7	166.6	84.0	81.7	165.7	72.2	77.5	149.7
Total nesting habitat	79.2	88.1	**167.3**	84.2	90.6	**174.8**	88.5	86.8	**175.3**	74.8	80.7	**155.5**
Breeding season foraging—natural	772.1	362.3	1,134.4	777.2	385.1	1,162.3	773.1	366.9	1,140.0	748.6	339.2	1,087.8
Breeding season foraging—agriculture	905.8	422.8	1,328.6	1,008.8	561.0	1,569.8	1,057.2	464.1	1,521.3	852.7	402.2	1,254.9
Total foraging habitat	1,677.9	785.1	**2,463.0**	1,786.0	946.1	**2,732.1**	1,830.3	831.0	**2,661.3**	1,601.3	741.4	**2,342.7**
Total tricolored blackbird habitat	1,757.1	873.2	**2,630.3**	1,870.2	1,036.7	**2,906.9**	1,918.8	917.8	**2,836.6**	1,676.1	822.1	**2,498.2**
Yellow-headed blackbird	6.7	3.9	10.6	6.7	3.9	10.6	6.7	3.9	10.6	6.7	3.9	10.6
Nonoverlapping total habitat	1,763.8	877.2	2,641.0	1,877.0	1,040.6	2,917.6	1,925.5	921.7	2,847.2	1,682.8	826.0	2,508.8
Sandhill Crane												
Greater sandhill crane												
Known roosting and foraging habitat	38.1	22.9	61.0	38.1	22.9	61.0	38.1	22.9	61.0	38.1	22.9	61.0
Potential roosting and foraging habitat	257.2	206.4	463.5	257.2	206.4	463.5	257.2	206.4	463.5	257.2	206.4	463.5
Total	295.3	229.3	**524.5**	295.3	229.3	**524.5**	295.3	229.3	**524.5**	295.3	229.3	**524.5**
Lesser sandhill crane												
Known roosting and foraging habitat	38.1	22.9	61.0	38.1	22.9	61.0	38.1	22.9	61.0	38.1	22.9	61.0
Potential roosting and foraging habitat	344.2	264.0	608.1	344.2	264.0	608.1	344.2	264.0	608.1	344.2	264.0	608.1
Total	382.3	286.9	**669.1**	382.3	286.9	**669.1**	382.3	286.9	**669.1**	382.3	286.9	**669.1**

Impacts	Alt 1			Alt 2			Alt 3			Alt 4		
	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total
San Joaquin Kit Fox												
High value suitable habitat	13.0	20.8	33.8	13.0	20.8	33.8	13.0	20.8	33.8	13.0	20.8	33.8
Moderate value suitable habitat	193.3	66.7	260.0	193.3	66.7	260.0	196.2	66.5	262.7	193.4	66.4	259.8
Low value suitable habitat	1,815.2	772.6	2,587.8	1,815.2	772.6	2,587.8	1,857.0	760.9	2,617.9	1,816.7	770.7	2,587.4
Total	2,021.5	860.1	**2,881.6**	2,021.5	860.1	**2,881.6**	2,066.2	848.2	**2,914.4**	2,023.1	857.9	**2,881.0**
Mountain Lion (Southern California/Central Coast ESU)[1]												
Breeding and foraging habitat	709.3	123.9	833.2	709.4	124.6	834.0	710.2	118.3	828.5	709.8	122.9	832.7
High-priority foraging and dispersal habitat	1,491.3	563.3	2,054.6	1,500.2	589.9	2,090.1	1,506.5	568.0	2,074.5	1,440.1	533.7	1,973.8
Low-priority foraging and dispersal habitat	497.4	328.7	826.1	605.0	478.4	1,083.4	634.8	375.2	1,010.0	447.5	288.2	735.7
Total	2,698.0	1,015.9	**3,713.9**	2,814.6	1,192.9	**4,007.5**	2,851.5	1,061.5	**3,913.0**	2,597.4	944.8	**3,542.2**
Fresno Kangaroo Rat												
Potentially suitable habitat	58.8	46.3	105.1	58.8	46.3	105.1	58.8	46.3	105.1	58.8	46.3	105.1
American Badger												
Potentially suitable habitat	798.6	374.5	1,173.1	805.4	399.3	1,204.7	799.6	378.9	1,178.5	778.4	350.7	1,129.1
San Francisco Dusky-Footed Woodrat and Ringtail												
Potentially suitable habitat	400.1	102.3	502.4	399.6	113.2	512.8	402.6	110.7	513.3	395.9	84.0	479.9
Special-Status Bats												
Pallid Bat												
Roosting and foraging habitat	1.9	14.7	16.6	1.5	13.7	15.2	1.9	14.7	16.6	0.0	4.6	4.6
Foraging habitat	2,680.6	1,431.1	4,111.7	2,895.0	1,903.1	4,798.1	2,738.0	1,450.6	4,188.6	2,448.0	1,106.7	3,554.7
Total	2,682.5	1,445.8	**4,128.3**	2,896.5	1,916.8	**4,813.3**	2,739.9	1,465.3	**4,205.2**	2,448.0	1,111.3	**3,559.3**
Townsends' Big-Eared Bat												
Roosting habitat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Impacts	Alt 1			Alt 2			Alt 3			Alt 4		
	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total	Perm	Temp	Total
Foraging habitat	1,601.6	519.3	2,120.9	1,659.0	711.4	2,370.4	1,755.7	562.3	2,318.0	1,423.7	426.8	1,850.5
Total	1,601.6	519.3	**2,120.9**	1,659.0	711.4	**2,370.4**	1,755.7	562.3	**2,318.0**	1,423.7	426.8	**1,850.5**
Western Mastiff Bat												
Roosting and foraging habitat	0.0	4.5	4.5	0.2	4.6	4.8	0.0	4.5	4.5	0.0	4.5	4.5
Foraging habitat	2,302.6	1,108.8	3,411.4	2,517.0	1,580.8	4,097.8	2,360.0	1,128.3	3,488.3	2,070.0	784.4	2,854.4
Total	2,302.6	1,113.3	**3,415.9**	2,517.2	1,585.4	**4,102.6**	2,360.0	1,132.8	**3,492.8**	2,070.0	788.9	**2,858.9**
Western Red Bat												
Roosting and foraging habitat	384.9	98.1	483.0	382.7	106.9	489.6	387.4	106.6	494.0	377.4	80.4	457.8
Foraging habitat	2,680.6	1,431.1	4,111.7	2,895.0	1,903.1	4,798.1	2,738.0	1,450.6	4,188.6	2,448.0	1,106.7	3,554.7
Total	3,065.5	1,529.2	**4,594.7**	3,277.7	2,010.0	**5,287.7**	3,125.4	1,557.2	**4,682.6**	2,825.4	1,187.1	**4,012.5**
Nonoverlapping total habitat	3,383.1	1,612.8	4,995.9	3,599.7	2,116.9	5,716.6	3,446.2	1,650.5	5,096.7	3,133.7	1,252.7	4,386.4

Nonoverlapping acreage reflects the *aggregate* areal extent of all species taken together—in other words, the exterior perimeter of the overlapping model boundaries, so that land where modeled habitat for more than one species is present is only counted once.
Alt = alternative; CESA = California Endangered Species Act; DPS = distinct population segment; EFH = essential fish habitat; ESU = evolutionarily significant unit; Perm = permanent; Temp = temporary
[1] Note that mountain lion populations outside of the Southern California/Central Coast ESU are not candidates for state listing under CESA and have no special status.

Table 3.7-14 Impacts on Critical Habitat by Project Alternative

Impacts	Alt 1		Alt 2		Alt 3		Alt 4	
	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp
Permanent Conversion or Degradation of Critical Habitat								
Bay checkerspot butterfly[1]	4.3	21.7	9.4	25.4	4.3	21.7	1.9	19.1
California tiger salamander[2]	213.1	65.4	213.1	65.4	213.1	65.3	213.1	65.4
California red-legged frog[3]	739.5	184.1	739.5	184.1	738.7	184.3	739.5	184.1
Steelhead—Central coast/south-central California coast DPS	5.1	3.1	5.8	3.6	5.9	3.5	5.0	2.5
Total	**962.0**	**274.3**	**967.8**	**278.5**	**962.0**	**274.8**	**959.5**	**271.1**

DPS = distinct population segment
[1] Impacts would occur in four critical habitat units—Tulare Hill (Unit 6), Hale (Unit 10), San Martin (Unit 12), and Kirby (Unit 13)
[2] Impacts would occur in two critical habitat units—Lion's Peak (Units 10A and 10B) and San Felipe (Unit 12)
[3] Impacts would occur in the Wilson Peak Unit (Unit STC-2)

The Authority has incorporated IAMFs into the project design to avoid and minimize project effects. The IAMFs particular to special-status plants will also pertain to most other biological and aquatic resources. The Authority will submit to the appropriate wildlife agencies the names and qualifications of project biologists, designated biologists, species-specific biological monitors, and general biological monitors retained to conduct biological resource monitoring activities and implement avoidance and minimization measures (BIO-IAMF#1). The project biologist will prepare a biological resources management plan (BRMP) consolidating permit conditions and an array of other requirements relevant to protection of sensitive biological resources (BIO-IAMF#5), including special-status species habitat. Workers will be provided with worker environmental awareness program (WEAP) training to help them understand their responsibilities in following procedures to reduce impacts and to increase their capability to identify and avoid special-status species and their habitat in the work area (BIO-IAMF#3). Staging areas will be sited away from sensitive resources (BIO-IAMF#8). The Authority will develop a best management practices (BMP) field manual that will address proper waste management and storage, nonstormwater management, and other general site cleanliness measures to avoid spills of hazardous materials, reducing degradation of suitable habitat (BIO-IAMF#11).

Excavated soils or waste materials unsuitable for treatment or reuse will be disposed at an off-site location (BIO-IAMF#9), avoiding degradation of habitat. Construction equipment will be cleaned before entering work areas to minimize opportunities for weeds and invasive species to enter the project footprint (BIO-IAMF#10).

The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat, habitat fragmentation, introduction and spread of invasive plants, hydrologic changes, and introduction of hazardous materials) on habitat for both listed and nonlisted special-status plant species is shown in Table 3.7-12. All four project alternatives would be nearly identical with respect to the number of species potentially affected. The aggregate magnitude of permanent and temporary impacts by alternative would be, in descending order, 1,190.8 acres and 467.5 acres, respectively, under Alternative 3; 1,185.9 acres and 487.1 acres under Alternative 2; 1,179.3 acres and 460.1 acres under Alternative 1; and 1,154.2 acres and 429.1 acres under Alternative 4.

While pre-construction and construction actions to protect habitat for special-status plants are part of the project, these actions would not prevent the permanent conversion of habitat and temporary disturbance of other habitat in the project footprint. Work to construct Tunnels 1 and 2 would affect the greatest area of special-status plant habitat because of the extent of undeveloped native plant communities at the portal sites (e.g., chaparral, oak woodland, California sycamore woodland). Construction activities would result in the temporary disturbance of habitat during construction and reduced habitat value for some period of time after construction is completed.

Effects Related to Tunnel Construction and Hydrologic Changes

The Authority has incorporated HYD-IAMF#5 into the design and construction methods for Tunnels 1 (Morgan Hill and Gilroy Subsection) and 2 (Pacheco Pass Subsection) to avoid or minimize groundwater inflows into and around tunnels during and after construction. As discussed in Impact HYD#10 in Section 3.8, although HYD-IAMF#5 will reduce the potential effect on groundwater levels due to tunnel construction, based on the available information and based on prior tunnel construction experience in the Pacheco Pass and elsewhere, some groundwater inflow into and around the tunnel will occur during construction. This groundwater flow could result in localized reduction of groundwater that could have temporary indirect effects on the hydrology of groundwater-dependent surface water features, including streams, creeks, springs, ponds and wetlands that provide habitat for special-status plants. For example, tunnel boring through an underground aquifer or fractured bedrock that conveys groundwater to a wetland on the surface could alter the duration of the feature's inundation or lower the water table, causing desiccation and mortality of special-status wetland plants. Within the tunnel groundwater study area, groundwater-dependent surface water features that provide habitat for special-status plants could also be affected. In addition, as discussed below, upland trees with deep roots that can reach to groundwater (such as oaks) could also be affected.

As discussed in Section 3.8, several sources of information have been developed to support the environmental process and guide the design of the proposed tunnels, including preliminary groundwater monitoring, plans and profiles of the tunnels in relation to geologic units, conceptual tunnel design reports, and technical design memoranda. As explained in Section 3.8, these documents summarize the existing information concerning groundwater conditions. Regarding biological resources over the tunnel alignments, available information includes aerial photography, mapping, and habitat typing using remote-sensing data. A major constraint on collecting information on groundwater, surface water, and biological resources over the tunnel alignment is the lack of site access at present.

While the available information is adequate to conclude that effects of tunnel construction on groundwater and surface water flows and biological resources supported by affected water resources are reasonably foreseeable, the Authority has determined that the information needed to fully and comprehensively identify the specific effects on groundwater and surface water hydrology and dependent biological resources is incomplete or unavailable. Therefore, the following analysis complies with the requirements described in 40 C.F.R. § 1502.22 concerning NEPA analysis when information is incomplete or unavailable. In accordance with this regulation, the following narrative is organized as follows:

- Statement of incomplete or unavailable information regarding tunneling effects
- Relevance of incomplete or unavailable information to evaluating tunneling effects
- Existing information relevant to evaluating tunneling effects
- Effect evaluation following theoretical approaches

The discussion applies to special status plant, fish and wildlife species, aquatic resources and protected trees. It is not repeated in discussions of other species and aquatic resources to avoid redundancy.

Statement of Incomplete or Unavailable Information Regarding Tunneling Effects

As discussed in Section 3.8, despite the preliminary assessments of subsurface conditions along the proposed tunnel alignments that have been conducted to date and the information derived from construction of other tunnels, many aspects of the groundwater conditions that would be encountered during tunnel construction have been only partially defined and there are data gaps surrounding bedrock, groundwater, soil, and surface hydrology conditions present in the vicinity of the proposed tunnels. Regarding biological resources, the potential biological resources found along the proposed tunnel alignments are generally identified in this document, but a specific inventory of biological and aquatic resources has not been prepared due to the lack of site access.

Additional data are planned to be collected during geotechnical investigations along the proposed tunnel alignments during the design phase once the Authority gains access to privately owned property overlying the proposed tunnel alignments, and these are discussed in Section 3.8. Once the Authority gains access, biological and aquatic resource inventories, similar to those prepared for areas where the Authority presently has access, will be prepared.

Much of the land overlying the proposed tunnels is privately owned, and these areas were inaccessible for field surveys and preliminary investigations into hydrologic and biological resource conditions during preparation of this environmental document. The Authority attempted to gain access to these areas to investigate these conditions during the environmental phase of the project, but the property owners did not grant permission to enter. At this time, the only avenue through which the Authority could gain access to these properties would be to acquire them through eminent domain. The process to exercise eminent domain is lengthy and would result in a delay to complete the NEPA/CEQA process.

Even assuming the Authority received permission to enter privately owned property overlying the tunnel for the purposes of obtaining the incomplete or unavailable information without going through eminent domain, and these investigations are performed as part of the environmental phase prior to completing the NEPA/CEQA process, it would result in a delay of the entire project of approximately 3 years. Such a delay would result in substantial cost increases in terms of both construction costs

due to escalation as well as costs associated with delayed operation of HSR service within the project extent. The Authority considers the cost of delay to be an exorbitant cost.

Relevance of Incomplete/Unavailable Information to Evaluating Tunneling Effects

As discussed in Section 3.8, understanding the potential groundwater conditions that may be encountered by a proposed tunnel is essential so that tunnel structures are designed to avoid and minimize project effects on groundwater and related surface water resources. Evaluating the existing hydrologic conditions of surface water resources overlying the tunnel alignments is essential to understanding the connections between groundwater and surface water flows. Predictive groundwater modeling methods can be used to estimate potential groundwater conditions that may be encountered by a proposed tunnel only when adequate input data, including site-specific geotechnical and hydrologic data collected by subsurface investigations, in situ monitoring, and field investigations, are available. Hydrologic information is also needed to fully and comprehensively identify specific effects on the biota of surface water features (including special-status species habitat) because some surface water features are influenced by groundwater but others are not (i.e., some but not all special-status species habitat in the tunnel groundwater study area would be affected). The species habitat models used to estimate direct impacts on special-status species in the project footprint are not appropriate for estimating effects on individual surface water features in the tunnel groundwater study area because the models are intended to evaluate effects at a much larger (i.e., landscape) scale. To refine the models so that potential groundwater effects could be analyzed requires additional site-specific knowledge of the hydrology of the existing features. This knowledge can only be gained by collecting hydrological data for each of the potentially affected features in the field.

A complete field investigation into the groundwater, surface water, and biological resources overlying the proposed tunnel alignments can only be conducted once the Authority gains access to the privately owned properties overlying the proposed tunnel alignments.

Lacking the detailed subsurface and field investigations into existing geologic, hydrologic, and biologic conditions overlying the proposed tunnels, the data needed to fully estimate the extent, intensity, and duration of tunneling effects on biological conditions are not available. Accordingly, the following narrative and analysis relies on existing data for the tunnel alignments, prior tunneling experience in the Pacheco Pass and elsewhere, and a relative risk assessment of areas of greater or lesser potential effects on biological resources

Existing Information Relevant to Tunnel Construction Effects

As explained in further detail in Section 3.8, based on the information gained from construction of the Irvington Tunnels and the Arrowhead Tunnels, it is expected that the proposed HSR tunnel construction is likely to affect groundwater and surface water resources within a maximum distance of approximately 1 mile from the tunnel alignments. However, similar to those tunnels, it is expected that only a subset of the resources within 1 mile would be affected. The groundwater and surface water resources that directly overlie or are within proximity to the proposed tunnel alignments are anticipated to have the highest potential to be affected by tunneling, with most effects located within 0.25 to 0.5 mile of the tunnel alignments and with many resources within 1 mile of the tunnel alignments having no effects or limited effects. As explained in Section 3.8, based in prior tunnel construction monitoring, these effects are expected to be temporary, lasting months or up to several years after the tunnels become watertight.

As explained in Section 3.8, groundwater conditions vary along the length of Tunnel 1 and Tunnel 2. While many sections have low hydraulic conductivity with a relatively lower potential for reduction in groundwater, there are localized areas, such as around the Ortigalita fault where tunnel inflows and potential changes to groundwater levels are likely high. As described in Section 3.8, based on the current understanding of geology and the prior experience of constructing Central Valley project tunnels in Pacheco Pass, the relative risk of groundwater reduction and resultant effects on groundwater dependent biological resources is as follows:

- Tunnel 1
  - The entire tunnel (1.5 miles) is expected to encounter mostly dry or moist conditions with inflows up to 15 gallons per minute persisting for up to several days. The relative risk of groundwater reduction on this segment is low.
- Tunnel 2
  - Approximately 8.1 miles of Tunnel 2 (segments A and B) is expected to encounter primarily moist conditions with local groundwater inflows up to or greater than 200 gallons per minute persisting for up to several days. The relative risk of groundwater reduction on this segment is high.
  - Approximately 4.3 miles of Tunnel 2 (segment C) is expected to be mostly dry to moist, with local heading inflows up to 100 gallons per minute persisting for up to several days. The relative risk of groundwater reduction on this segment is moderate
  - Approximately 0.2 mile of Tunnel 2 (segment D) would pass through or near the Ortigalita fault zone, which may contain substantial quantities of groundwater. The relative risk to groundwater reduction on this segment is high
  - Approximately 1 mile of Tunnel 2 (segment E) is expected to encounter mostly dry or moist conditions with temporary inflows up to 15 gallons per minute persisting for up to several days. The relative risk of groundwater reduction on this segment is low.

Effect Evaluation using Theoretical Approaches

Based on the information gained from construction of the Irvington Tunnels and the Arrowhead Tunnels, it is expected that the proposed HSR tunnel construction is likely to affect groundwater and surface water resources within a maximum distance of approximately 1 mile from the tunnel alignments, with most effect occurring on groundwater and surface water (and groundwater-dependent biological resources) located directly over the alignment and within 0.25 to 0.5 mile of the alignment.

Assuming that the proposed design and construction methods (HYD-IAMF#5) will not completely avoid the potential for groundwater inflows during tunneling, and that the quantity of groundwater inflows into the proposed tunnels will indicate a corresponding effect on surface hydrology conditions, a relative risk for effects on groundwater-dependent biological resources can be assigned to specific segments of the proposed tunnels. To generate this relative risk assessment, locations where more groundwater inflows are anticipated were assumed to have a higher potential for groundwater and surface hydrology effects; conversely, locations where less groundwater would be encountered were assumed to have a lower potential for groundwater and surface hydrology effects. While this theoretical approach to evaluating the potential effect provides a useful tool for identifying segments of the tunnels that are more or less vulnerable to surface water effects in comparison to other portions of the tunnels, it does not allow for a full evaluation of foreseeable effects, including extent, intensity, or duration. Given the current uncertainties and data gaps, there is potential for surface water effects to occur even in locations with a low risk of effect, and there could be instances where little groundwater inflow would occur in areas with a high risk for effect.

Table 3.8-28 in Section 3.8 shows the relative risk for effects from tunneling on groundwater and surface water resources that have the highest potential to be affected (i.e., features that cross directly over or very close to the tunnel alignments). Figures 3.8-12 to 3.8-15 in Section 3.8 illustrate the alignments of the proposed tunnels in relation to the locations of seeps/springs and surface water resources.

Surface water resources within 1 mile of the proposed tunnel alignments include the following: 132 streams and creeks; 42 wetlands, ponds, and reservoirs; and 11 seeps and springs. However, not all of these resources are expected to be affected by tunnel construction because of the following: (1) many of the streams and creeks are likely not supported by groundwater flow; (2) most of the tunnel alignment is in areas of low groundwater conductivity where groundwater

flows are expected to be limited and the implementation of HYD-IAMF#5 would lower the potential for large-scale effects to reach every feature within the RSA; and (3) prior tunneling experience has indicated that the bulk of the effects on water resources would occur on resources located over the tunnel alignment or much closer to the alignment than 1 mile.

Table 3.8-28 and Figures 3.8-12 to 3.8-15 in Section 3.8 show that tunnel construction may directly or indirectly affect water levels in 43 creeks, 3 ponds, the San Luis Reservoir, and a seep/spring. Of these 48 resources overlying or in proximity to the proposed tunnel alignments, the hydrology of 44 waterbodies have the potential to be directly affected by groundwater reduction associated with tunneling, and three other waterbodies (Ortega Creek, Romero Creek, and San Luis Reservoir) could be indirectly affected through altered hydrology of their tributaries). The potential for all surface water resources overlying the tunnels to be affected is expected to vary along the tunnel alignment: the waterbodies near Tunnel 1 and segment E of Tunnel 2 have a relatively low risk for hydrology effects, while the remainder of Tunnel 2 has a moderate to high potential to affect surface water hydrology.

The types and approximate number of surface water features within 250 feet of the underground easements for the two tunnels are shown in Table 3.7-15. Other surface water features within the tunnel groundwater study area (i.e., greater than 250 feet from the project footprint but within 1 mile of underground easements for tunnels) may also be affected. The impact on groundwater-dependent surface water features from tunnel construction would be the same under all four alternatives because their alignments are identical at the two tunnels.

Table 3.7-15 Surface Waters Overlying Tunnels 1 and 2[1]

Aquatic Resource	Tunnel 1	Tunnel 2
Freshwater marsh	0	1
Freshwater pond	1	9
Natural watercourse[2]	11	91
Seasonal wetland	0	4

[1] The 250-foot buffer was chosen for this table because it is the same distance at which indirect impacts on aquatic resources are evaluated and conservatively estimates the number of surface features that could be affected by tunnel construction underground. Other surface water features within 1 mile of the underground easements for the tunnels could also be affected but are not quantified for this analysis.
[2] Reflects number of crossings over the tunnel easements

Upland vegetation such as grassland and shrubs would not be affected by potential groundwater reduction because these vegetation types and shallow roots and are not dependent on groundwater, and thus are not discussed further. However, certain upland trees, such as oaks, can have deep roots that can reach to groundwater. Within the groundwater study area, common upland oak tree species include blue oak, coast live oak, and scrub oak and valley oak are found within riparian areas of the study area. Oaks derive water from direct precipitation, shallow infiltration, the vadose zone above groundwater, and groundwater. While oaks (and other trees) have their vast bulk of their roots located within 1 to 2 meters (3 to 6 feet) of the surface (Perry 1989), some oaks, can have deep roots that can reach 50–100 feet below the surface level (Lewis and Burgy 1964). It possible that some oaks could be sustaining themselves in part from groundwater, particularly in summer or drought conditions. As discussed in Section 3.8, the groundwater study area is a complex geological area with extensive local faulting and the water table elevation has not been comprehensively mapped to date. Therefore, it is possible that upland trees may be affected if they are located in areas with a relatively shallow water table (defined for this analysis as up to 100 feet). It should be noted that upland trees are primarily dependent on direct precipitation and shallow saturation of their primary root mass for water and are therefore less likely to be affected by a lowering of the groundwater table. In contrast, riparian trees like valley oak trees are more perennially dependent on surface and shallow groundwater. Therefore, potential groundwater lowering in the study area would not affect the primary source of

water for upland trees but could affect the “reserve” water source provided by deep tree roots in areas where the water table is shallow enough to be reached by tree roots.

The duration of temporary effects for any biological resource would depend on the hydrologic conditions, subsurface conditions, and amount of groundwater inflow into the tunnel, none of which can be estimated at this time as discussed under Impact HYD-10 in Section 3.8. As discussed under Impact HYD-10 in Section 3.8, the duration of groundwater inflows into and around the tunnel at any one location is expected to be a matter of days to months; the potential period of effect on groundwater due to tunnel construction could be days to months up to several years after tunnel completion. As explained in Section 3.8, post-project monitoring of surface water features near the Arrowhead Tunnels in the San Bernardino Mountains in southern California found that groundwater recovery from tunnel construction period effects took up to 5 years for some features (Berg 2012).

As discussed in Section 3.8, groundwater reduction and effects on biological resources indirectly dependent on groundwater is not anticipated to occur during project operation because designs which permanently limit or eliminate the leakage of water into the tunnel following construction would be used.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have substantial adverse effects, through conversion or degradation of habitat, on special-status plant species, including species listed under FESA and CESA. While actions would be implemented before and during construction to reduce the potential for direct impacts on special-status plants and to minimize the loss of habitat, the project would result in loss and degradation of habitat and could result in in the loss of special-status plant occurrences. These impacts would eliminate or reduce the viability of local occurrences and contribute to rangewide or statewide declines of these species. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#2a: Permanent Conversion or Degradation of Habitat for and Mortality of Bay Checkerspot Butterfly

Construction of the HSR track and systems in the Monterey Corridor and Morgan Hill and Gilroy Subsections would take place in suitable grassland habitat (including designated critical habitat in the Morgan Hill and Gilroy Subsection) for Bay checkerspot butterfly, a species listed as threatened under FESA. Construction activities would convert and destroy grassland habitat and could result in individual fatalities; presence of HSR components could interfere with necessary life cycle behaviors. The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1) into project design to avoid and minimize impacts on Bay checkerspot butterfly.

The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat) on habitat for the species is shown in Table 3.7-13. Impacts on critical habitat are shown in Table 3.7-14. Because of its larger project footprint in the Tulare Hill area, Alternative 2 would have the most extensive impacts on suitable habitat. The impacts under Alternatives 1 and 3 would be identical. Alternative 4 would have the least impact because of its reduced footprint in the Coyote Valley (Morgan Hill and Gilroy Subsection). Other direct impacts could include mortality and injury of individual adults, eggs, and larvae. The magnitude of permanent and temporary impacts would be 9.8 acres and 22.6 acres, respectively, under Alternatives 1 and 3; 14.7 acres and 27.7 acres under Alternative 2; and 10.9 and 14.5 acres under Alternative 4. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without habitat for Bay checkerspot butterfly, and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

The magnitude of indirect impacts (habitat modification through introduction of invasive nonnative plants, alteration of flight behavior), while not quantified, would generally be proportional to the quantity of direct impacts except for potential long-term impacts on flight behavior. Bay checkerspot butterflies generally follow landform contours close to the ground surface, and they avoid patches of shade in their flight path. The general direction of flight would be east to west across the alignment, from Coyote Ridge (the core population) to suitable habitat west of U.S. Highway 101 on Tulare Hill or at Santa Teresa Park. Consequently, Alternatives 1 and 3 have the potential to alter flight behavior because the shadow created by the viaduct could create a barrier to movement. Alternatives 2 and 4 would have the least impact on flight behavior because both alternatives would be at grade in Coyote Valley. Alternative 2 would result in more extensive conversion of butterfly habitat than Alternative 4.

Although serpentine grasslands are typically more resistant to invasion by nonnative species than many other land cover types, nonnative species eventually degrade serpentine grasslands. For example, barbed goatgrass (*Aegilops triuncialis*) is an invasive grass that has been documented on Coyote Ridge and is the subject of focused management and monitoring by the SCVOSA (McGraw 2015: page 68).

While actions to minimize habitat disturbance are part of the project, construction would result in loss and disturbance of habitat for Bay checkerspot butterfly. Construction activities could crush host plants supporting egg masses and larvae, and ground- and vegetation-disturbing activities conducted during March and April could kill adults feeding on nectar plants. Alternative 2 would result in the loss of more habitat than Alternatives 1, 3, and 4 because it would involve additional staging areas or temporary construction easements (TCE) in suitable habitat; on the other hand, the viaduct associated with Alternatives 1 and 3 could impede butterflies' movement between habitat patches because they can perceive shadows as impassable barriers.

CEQA Conclusion

The impact under CEQA would be significant for all four project alternatives because construction activities would have a substantial adverse effect, through both direct mortality and habitat modification, on the Bay checkerspot butterfly. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in loss of habitat for Bay checkerspot butterfly (including critical habitat), could result in long-term behavioral changes in flight patterns, and could cause direct impacts on individuals (injury and mortality) if any are present in affected habitat. In the absence of mitigation, such impacts would reduce the viability of the Coyote Ridge core population, which is the only remaining population of this species. Any habitat loss in this area would reduce opportunities for recovery of this endangered species. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#2b: Permanent Conversion or Degradation of Habitat for and Mortality of Monarch Butterfly

Construction of the HSR track and systems in all subsections would take place in suitable habitat (which could support breeding host plants [milkweed plants], or other nectar sources [a variety of flowering plants]) for monarch butterfly, a species that became a candidate for listing under FESA on December 15, 2020. Construction activities would convert and destroy suitable habitat and could result in individual fatalities of monarch butterflies if they are present at the time of construction. Additionally, fugitive dust during construction could affect monarch butterflies if they are near the construction area at the time construction occurs. Furthermore, fugitive dust could temporarily affect host or nectar plants by covering leaves and reducing the vigor of plants. The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (these measures and how they will avoid and minimize potential effects are described in Impact BIO#1) into the project design to avoid and minimize impacts on wildlife and plants from construction. As these IAMFs are widely applicable to all species, they will also avoid and minimize impacts on monarch butterfly.

Direct impacts could include mortality and injury of individual adults, eggs, and larvae, as well as the conversion and disturbance of suitable habitat. The areal extent of direct permanent and temporary habitat impacts for the species is shown in Table 3.7-13. All four project alternatives would have generally similar impacts on the monarch butterfly. While suitable habitat is present in all five subsections, the greatest amount is in the Pacheco Pass and San Joaquin Valley Subsections, where all four alternatives would be identical. The most extensive impacts on suitable habitat would result from work on the portals for Tunnel 1 in the Pacheco Pass Subsection, requiring large areas of grading and earthmoving for slope stabilization. The other differences between alternatives would be in the Monterey Corridor and Morgan Hill and Gilroy Subsections. Alternatives 2 and 3 would have the most extensive potential impacts because they would be largely on embankment in those subsections, resulting in a larger project footprint and more ground disturbance. Alternative 4 would have the least impact because of its reduced footprint associated with the existing at-grade Caltrain tracks. However, it should be noted that monarch butterflies depend solely on milkweed plants for completing their life cycle, and milkweed plants are not expected to be present in all suitable habitat. Milkweed plants are expected to be restricted to small patches or isolated individual plants in most locations, and thus the estimates of suitable habitat affected are likely overestimating potential impacts on suitable breeding/rearing habitat (Table 3.7-13). Monarchs have a very broad migratory range/distribution across western North America from their overwintering habitat on the coast toward the north and east. Because HSR trains would operate intermittently and because seasonal migration is so diffuse across western North America, trains are unlikely to introduce a substantial barrier to movement. While some impacts on individuals from train strike could occur, large groups of monarchs do not migrate together, and thus substantial mortality is not likely to occur. Consequently, impacts on movement are considered less than significant and will not be discussed further.

As discussed in Impact BIO#1, construction of Tunnels 1 and 2 could have temporary indirect impacts on the hydrology of groundwater-dependent surface waters and associated vegetation types. Milkweed host plants are relatively shallow-rooted herbaceous perennials that commonly occur in upland habitats, are not likely to be dependent on groundwater, and thus are unlikely to be affected by dewatering. Monarch also uses a number of other herbaceous plants and several shrubs and trees as nectar sources (Xerces Society 2019). Similar to milkweeds, herbaceous nectar plants have relatively shallow root systems and are not likely to be dependent on groundwater. Shrubs and trees known to be used by monarch and that are likely to occur within the study area include coyotebrush (*Baccharis* spp.), goldenbush (*Ericameria* spp.), manzanita (*Arctostaphylos* spp.), willow (*Salix* spp.), and potentially other species. One or more of these species (especially willow) may occur in areas affected by groundwater dewatering and may be affected, because they are dependent or partially dependent on groundwater.

The magnitude of permanent and temporary impacts on suitable habitat would be 3,844.8 acres and 1,501.0 acres, respectively, under Alternative 1; 3,902.8 acres and 1,704.0 acres under Alternative 2; 3,999.4 acres and 1,549.4 acres under Alternative 3; and 3,677.2 acres and 1,415.1 acres under Alternative 4. The magnitude of indirect impacts (habitat modification through introduction of invasive nonnative plants), while not quantified, would generally be proportional to the quantity of direct impacts. Invasion by nonnative plant species can affect and degrade numerous land cover types that support breeding host plants as well as nectar plants. While actions to minimize habitat disturbance are part of the project, construction would result in loss and disturbance of habitat for monarch butterfly. Construction activities could crush host plants supporting egg masses and larvae, and ground- and vegetation-disturbing activities conducted during the breeding or migratory season could kill adults feeding on nectar plants.

CEQA Conclusion

The impact under CEQA would be significant for all four project alternatives because construction activities would have a substantial adverse effect, through both direct mortality and habitat modification, on the monarch butterfly. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in loss of habitat for monarch butterfly and could cause direct

impacts on individuals (injury and mortality) if any are present in affected habitat. In the absence of mitigation, such impacts would reduce the numbers and breeding habitat for the species, which although only constituting a small portion of the range, would contribute to the decline of this species. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#3: Permanent Conversion or Degradation of Habitat for and Mortality of Vernal Pool Crustaceans

Construction of the HSR track and systems in the San Joaquin Valley Subsection would take place in suitable habitat for four federally listed vernal pool crustaceans: Conservancy fairy shrimp, longhorn fairy shrimp, and vernal pool tadpole shrimp, all listed as endangered under FESA; and vernal pool fairy shrimp, listed as threatened. Construction in the Morgan Hill and Gilroy and Pacheco Pass Subsections would take place in suitable habitat for vernal pool tadpole shrimp. Construction activities would convert habitat and could result in the mortality of individual crustaceans or their cysts, as well as degrading habitat that is not directly affected. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives and thus would not change construction effects on any biological resources. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources. The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1) into project design to avoid and minimize impacts on vernal pool crustaceans.

All four species are entirely aquatic, although their cysts remain dormant in the soil during the summer and fall when vernal pools are dry. All vernal pool invertebrate species occurrences in the regional RSA are associated with vernal pools, alkali sink scrub, and alkali grassland in the San Joaquin Valley and lower Sierra Nevada foothills east of Merced, with the exception of longhorn fairy shrimp, which is associated with grassland vernal pools in the San Joaquin Valley, and vernal pool tadpole shrimp, for which suitable habitat is present in seasonal wetlands of the Santa Clara Valley. With the exception of vernal pool tadpole shrimp, which also occurs in the Morgan Hill and Gilroy and Pacheco Pass Subsections, all potentially suitable habitat for the four species is limited to the San Joaquin Valley Subsection because the species' ranges overlaps only this subsection.

Because of the limited extent and fragility of vernal pool habitat for these species, all impacts are considered permanent. The areal extent of direct permanent impacts (conversion and disturbance of habitat, mortality of individuals and cysts) on suitable habitat for the species is shown in Table 3.7-13. Because all four alternatives would be identical in the San Joaquin Valley Subsection, there would be no difference in the area of impacts among alternatives. All four alternatives would affect 27.6 acres of suitable habitat for these species. While the USFWS has designated critical habitat for vernal pool ecosystems as well as for all four crustacean species, the project would not intersect or affect any critical habitat units.

While pre-construction and construction actions to protect habitat for listed vernal pool crustaceans are part of the project, these actions would not prevent the conversion and disturbance of habitat in and near the project footprint. If construction in the project footprint alters a hydrologic regime that supplies water to vernal pools within 250 feet of the footprint, such hydrological modifications could indirectly affect habitat by altering the pools' ponding duration and causing pools to evaporate before vernal pool crustaceans complete their life cycles (USFWS 2005: page I-20). Similarly, ground-disturbing activities that result in perforation or fracture of the water-restricting layer that allows vernal pools to pond could, even outside the project footprint, lead to the loss of suitable habitat.

CEQA Conclusion

The impact under CEQA would be significant for all four project alternatives because construction activities would have a substantial adverse effect, both directly and indirectly and through habitat modification, on Conservancy fairy shrimp, longhorn fairy shrimp, vernal pool fairy shrimp, and

vernal pool tadpole shrimp. While actions would be implemented before and during construction to reduce the potential for direct harm to populations and to minimize the loss of habitat, the project would nevertheless result in loss of a habitat type that has already experienced considerable decline. In the absence of mitigation, such loss would reduce the viability of local populations and contribute to the decline of federally listed species that are dependent upon a sensitive habitat type. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#4: Removal or Pruning of Elderberry Plants Potentially Supporting Valley Elderberry Longhorn Beetle

Construction of the HSR track and systems in the San Joaquin Valley Subsection would take place in habitat for valley elderberry longhorn beetle, a species listed as threatened under FESA. Construction could necessitate the removal of red or blue elderberry—the obligatory host species for the beetle. The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1) into project design to avoid and minimize impacts on valley elderberry longhorn beetle.

The areal extent of direct permanent impacts (conversion and disturbance of habitat, mortality of individuals) on riparian and other habitat for the species is shown in Table 3.7-13. Because all four alternatives would be identical in the San Joaquin Valley Subsection, there would be no difference in the extent of impacts between alternatives. All four project alternatives would result in permanent and temporary impacts on up to 102.6 acres and 56.3 acres, respectively, of suitable habitat. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives and thus would not change construction effects on any biological resources. While the USFWS has designated critical habitat for valley elderberry longhorn beetle, the project would not intersect any critical habitat units.

While pre-construction and construction actions to protect habitat for valley elderberry longhorn beetle are part of the project, these actions would not prevent the loss of habitat in the project footprint. Because of the dependence of this species on host plants, loss of occupied host plants would result in mortality of individual beetles.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both direct mortality and habitat modification, on valley elderberry longhorn beetle. While actions would be implemented before and during construction to reduce the potential for direct harm to occupied host plants and to minimize the loss of habitat (i.e., unoccupied host plants that could be occupied in the future), the project would nevertheless result in removal of riparian vegetation that could support host plants. If such host plants were occupied by valley elderberry longhorn beetles, their removal would result in take of a federally listed species. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#5: Permanent Conversion or Degradation of Habitat for and Mortality of Crotch Bumble Bee

Construction of the HSR track and systems in all subsections would take place in suitable habitat for the Crotch bumble bee, a candidate for listing as endangered under CESA. Construction activities would convert and disturb habitat and could result in the mortality of individual bees if underground nest colonies or overwintering queens are present in the project footprint at the time of construction. The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1) into project design to avoid and minimize impacts on Crotch bumble bee.

The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat) on habitat for the species is shown in Table 3.7-13**.** The magnitude of permanent and temporary impacts would be, in descending order, 1,154.5 acres and 461.8 acres, respectively,

under Alternative 2; 1,148.8 acres and 444.0 acres under Alternative 3; 1,147.2 acres and 436.4 acres under Alternative 1; and 1,127.0 and 412.7 acres under Alternative 4. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without habitat for crotch bumble bee and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

While pre-construction and construction actions to protect habitat for the Crotch bumble bee are part of the project, these actions would not prevent the conversion and disturbance of habitat in and near the project footprint. Ground disturbance could crush or excavate underground burrows supporting active nest colonies or soils or leaf litter supporting overwintering queens.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both direct mortality and habitat modification, on the Crotch bumble bee. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in loss of habitat for Crotch bumble bee and could cause direct impacts on individuals if any are present in affected habitat. In the absence of mitigation, such impacts would reduce the viability of local populations and contribute to the rangewide decline of the species. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#6: Permanent Conversion of Habitat for and Direct Mortality of Steelhead and Pacific Lamprey, and Permanent Conversion of Essential Fish Habitat for Pacific Coast Salmon

Construction of HSR track and systems in all subsections except the San Joaquin Valley Subsection would take place in habitat for steelhead and Pacific lamprey and designated freshwater EFH for Pacific Coast salmon (collectively referred to as special-status fish). Central California coast (CCC) and south-central California coast (SCCC) steelhead are both federally listed as threatened under FESA, Pacific lamprey is a federal species of concern and a CDFW species of special concern, and the project extent intersects designated EFH for Chinook and coho salmon. Construction activities would result in permanent conversion of some habitat to transportation uses and could cause injury and mortality to individual fish that are present in work areas. Because such activities could adversely affect EFH for Pacific Coast salmon by altering the physical, chemical, or biological conditions of affected steams, consultation with NMFS would be required and effects would be described in the BA.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1) into project design to avoid and minimize impacts on steelhead, Pacific lamprey, and EFH. In addition, the Authority will require preparation of other plans to guide project activities: preparation and implementation of a stormwater pollution prevention plan and plans governing the handling and management of hazardous materials (HMW-IAMF#3 and HMW-IAMF#6, respectively, as described in Section 3.10, Hazardous Materials and Wastes) will minimize the risk of contaminants discharging into waterbodies. Tunnels will be designed and constructed to avoid or minimize groundwater inflows into tunnels during construction that may affect surface water resources, including Pacheco Creek (HYD-IAMF#5).

The areal extent of direct permanent and temporary impacts (conversion and temporary dewatering of habitat, injury or mortality resulting from pile-driving activities) on habitat for the species is shown in Table 3.7-13. The magnitude of permanent and temporary impacts by alternative would be, in descending order, 177.4 acres and 80.6 acres, respectively, under Alternative 3; 159.4 acres and 88.2 acres under Alternative 2, 157.3 acres and 82.9 acres under Alternative 1, and 154.9 acres and 73.4 acres under Alternative 4. The project would also intersect designated critical habitat for CCC and SCCC steelhead as shown in Table 3.7-14. In the Morgan Hill and Gilroy Subsection, Alternative 2 would affect more habitat and designated

critical habitat for SCCC steelhead than Alternatives 1, 3, and 4 because of TCEs over Llagas Creek; at the same time, Alternative 3 would affect more critical habitat for SCCC steelhead than Alternatives 1, 2, and 4 because of additional crossings of the Pajaro River and Llagas Creek. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without wetlands, waters, or habitat for steelhead or Pacific lamprey or EFH and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

Floodplain habitats used by steelhead would be affected under all project alternatives, though impacts will be minimized through a variety of project design and construction features (HYD-IAMF#2). At the Guadalupe River and Llagas Creek crossings, bridge abutments or pile bents would be placed in the floodplain; there would be minimal physical barriers which would not impede fish movement in the floodplain in these areas. In the Soap Lake floodplain, the project would be constructed as viaduct in Alternatives 1, 3, and 4; viaduct columns would not obstruct flow or steelhead movement in the floodplain, but maintenance of way facility (MOWF) construction would place fill in the floodplain west of the Pajaro River crossing. The project would maintain circulation of flood flows around and past the MOWF. Moreover, the MOWF is located high in the floodplain, and would not obstruct most flood flows (i.e., the 10-year or more frequent flood). The alignment in the vicinity of Soap Lake would be on embankment in Alternative 2, and culverts incorporated into project design would ensure maintenance of flow across the alignment during times of flooding. In upper Pacheco Creek, the alignment in the vicinity of the floodplain under all four alternatives would be viaduct, with columns placed in the floodplain. The columns would not obstruct flood flows or steelhead movement. However, local small areas of fill would be placed in the floodplain along its southern edge. Design in accordance with HYD-IAMF#2 will minimize the hydraulic effects of fill.

As discussed in Impact BIO#1, construction of Tunnels 1 and 2 could have temporary indirect impacts on the hydrology of groundwater-dependent surface waters, including habitat and designated critical habitat for SCCC steelhead in Pacheco Creek near Casa de Fruta (i.e., northeast of Tunnel 1 and northwest of Tunnel 2). A drop in groundwater inflow to Pacheco Creek (directly or via upstream tributaries) could alter instream habitat conditions and fish movement potential. As discussed in Impact HYD-10 in Section 3.8, the duration of this impact would depend on the hydrologic conditions, subsurface conditions, and the amount of lowering of groundwater tables or tunnel dewatering discharge, none of which can be estimated at this time.

In addition, if tunnel dewatering discharges at the Tunnel 2 west portal were routed to Pacheco Creek, such discharges could affect fish movement through the scour of creeks or banks that could alter channel conditions as well as through the introduction of abnormally warm water that could be a thermal barrier to safe fish passage. As discussed in Section 3.8, to meet water quality standards for beneficial reuse, settling ponds, storage tanks, and a series of treatment systems may be necessary. Only treated groundwater that meets appropriate water quality standards would be beneficially reused or discharged into receiving waterbodies. The application of regulatory discharge controls would avoid water quality effects related to fish habitat conditions and fish movement.

While pre-construction and construction actions to protect habitat for special-status fish species are part of the project, these actions would not prevent the conversion and disturbance of aquatic habitat where work must be conducted. In addition to habitat loss and temporary disturbance, construction activities could temporarily limit fish access to seasonal floodplain habitats; temporarily remove riparian vegetation, resulting in decreased stream shading; ground-disturbing activities could result in increased sediment discharge; and dewatering could result in stranding and death of individual fish.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both direct mortality and habitat modification, on steelhead, Pacific lamprey, and EFH for Pacific Coast salmon. While actions would be

implemented before and during construction to minimize the loss of habitat, the project would result in loss of habitat and could result in mortality of individuals, if present in affected habitat. Such loss would constitute a substantial adverse impact because the loss of even a few reproductive adults in these small populations can substantially reduce subsequent years' population levels and reproductive potential. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#7: Permanent Conversion or Degradation of Habitat for and Direct Mortality of California Tiger Salamander

Construction of the HSR track and systems in all subsections would take place in suitable habitat for the California tiger salamander, a species listed as threatened under the FESA and CESA. Such activities would convert suitable habitat and reduce the quality of the remaining suitable habitat, and could result in the injury or mortality of individual California tiger salamanders.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1) into project design to avoid and minimize impacts on California tiger salamander. In addition, erosion control materials that could entrap salamanders will be prohibited (BIO-IAMF#6) to prevent mortality and harm associated with inadvertent entrapment. Covering trenches, pits, and other excavations when not in use and inspecting them regularly (BIO-IAMF#7) will prevent salamanders from falling into these areas and being trapped there. Tunnels will be designed and constructed to avoid or minimize groundwater inflows into the tunnel during construction that may affect surface water resources in areas overlying the tunnel alignment (HYD-IAMF#5), including those that provide aquatic habitat for California tiger salamander.

The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat) on aquatic and upland (both agricultural and nonagricultural) habitat for the species is shown in Table 3.7-13. The magnitude of permanent and temporary impacts by alternative would be, in descending order, 2,447.8 acres and 956.5 acres, respectively, under Alternative 3; 2,305.1 acres and 1,087.6 acres under Alternative 2; 2,249.1 acres and 910.6 acres under Alternative 1, and 2,126.4 acres and 842.2 acres under Alternative 4. In addition to habitat loss, other direct impacts could include injury and mortality of individual salamanders through such mechanisms as vehicle strike, entrapment in construction areas or materials, and crushing or entombment in burrows. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without wetlands, waters, or habitat for California tiger salamander and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

All four project alternatives would have generally similar impacts on the California tiger salamander. While suitable habitat is present in all five subsections, the greatest amount is in the Pacheco Pass and San Joaquin Valley Subsections, where all four alternatives would be identical. The most extensive impacts on suitable habitat would result from work on the portals for Tunnel 1 in the Pacheco Pass Subsection, requiring large areas of grading and earthmoving for slope stabilization. The other differences between alternatives would be in the Monterey Corridor and Morgan Hill and Gilroy Subsections. Alternatives 2 and 3 would have the most extensive potential impacts because they would be largely on embankment in those subsections, resulting in a larger project footprint and more ground disturbance. Alternative 4 would have the least impact because of its reduced footprint associated with the existing at-grade Caltrain tracks.

Additionally, as shown in Table 3.7-14, the project would have impacts on two units of designated critical habitat. The impacts associated with work on Tunnel 1 would take place in the San Felipe Unit (Unit 12). Primarily temporary impacts would result from Pacific Gas and Electric Company (PG&E) work to upgrade the electrical network in the Lion's Peak Units (10A and 10B), but these impacts would not be extensive. Impacts on California tiger salamander critical habitat would be nearly identical for all four alternatives because their footprints are nearly the same at Tunnel 1 and PG&E work would occur at the same locations.

As discussed in Impact BIO#1, construction of Tunnels 1 and 2 could have temporary indirect impacts on the hydrology of groundwater-dependent surface waters, including ponds that provide aquatic breeding habitat for California tiger salamander. The majority of the area subject to potential temporary indirect effects is within the range and has the correct general habitat attributes to be suitable aquatic and upland habitat for California tiger salamander and thus would likely support breeding, foraging, and refugia of the species. Because hydroperiod and the amount of emergent wetland vegetation are two of the most important factors influencing suitability of a given pond for California tiger salamander (Ford et al. 2013: page 11), any reductions in groundwater supply to occupied ponds could reduce reproductive success of salamanders breeding in such ponds.

While pre-construction and construction actions to protect the tiger salamander are part of the project, these actions would not prevent the conversion of habitat and temporary disturbance of other habitat in the project footprint. Because the salamanders are small and can be distributed throughout suitable habitats, their exclusion from construction areas cannot be guaranteed. Earthmoving, excavation, and vehicle operation during construction could crush, entomb, or physically disturb the salamanders. Ground disturbance, noise, and vibration associated with these activities could disrupt the activities of individual salamanders and may impair normal life cycle behaviors. The use of chemicals and hazardous substances during construction (e.g., oils, gasoline) may also cause salamander mortality if individuals enter aquatic habitat that has been contaminated by accidental spills or other vehicle and equipment leaks. If construction in the project footprint alters a hydrologic regime that supplies water to vernal pools (suitable breeding habitat for the species) within 250 feet of the footprint, such hydrological modifications could indirectly affect habitat by altering the pools' ponding duration and rendering aquatic habitat unsuitable to support breeding behavior and the development of eggs and larvae. The introduction of nonnative plant species to upland habitat could reduce California tiger salamander dispersal to nonbreeding sites (i.e., burrows) because dense herbaceous vegetation could impede movement. While many protections would be implemented, the potential for physical harm and mortality of individuals would not be eliminated.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both direct mortality and habitat modification, on the California tiger salamander. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in substantial loss and degradation of habitat and could cause injury or mortality of individuals. In the absence of mitigation, such impacts would reduce the viability of local populations and contribute to the rangewide decline of species, and could also impede recovery of the species in historical portions of its range. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#8: Permanent Conversion or Degradation of Habitat for and Direct Mortality of California Red-Legged Frog

Construction of the HSR track and systems in all subsections except the San Joaquin Valley Subsection would take place in suitable habitat for the California red-legged frog, a species listed as threatened under the FESA and a CDFW species of special concern. Such activities would convert habitat and reduce the quality of the remaining suitable habitat, and could result in the injury or mortality of individual red-legged frogs.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#6, BIO-IAMF#7, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1 and Impact BIO#6) into project design to avoid and minimize impacts on California red-legged frog. Tunnels will be designed and constructed to avoid or minimize groundwater inflow into tunnels during construction that may affect surface water resources overlying the tunnel alignment (HYD-IAMF#5), including those that provide aquatic habitat for California red-legged frog.

The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat, injury and mortality of individuals) on breeding and nonbreeding habitat for the species is shown in Table 3.7-13. The magnitude of permanent and permanent impacts by alternative would be, in descending order, 2,160.0 acres and 1,173.5 acres, respectively, under Alternative 2; 2,119.3 acres and 882.3 acres under Alternative 3; 1,990.4 acres and 847.2 acres under Alternative 1; and 1,812.5 acres and 657.2 acres under Alternative 4. In addition, the USFWS has designated critical habitat for this species; all four alternatives would affect nearly identical amounts of this critical habitat (Unit STC-2). The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without wetlands, waters, or habitat for California red-legged frog and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

As discussed in Impact BIO#1, construction of Tunnels 1 and 2 could have temporary indirect impacts on the hydrology of groundwater-dependent surface water features, including ponds, wetlands, streams, and riparian vegetation that provide habitat for California red-legged frog. Because California red-legged frog breeding sites must be inundated long enough to allow for tadpole development and metamorphosis (Ford et al. 2013: page 5), any reductions in groundwater supply to occupied ponds, streams, or wetlands could reduce reproductive success of the affected population. Reductions in groundwater supply to riparian vegetation could result in the desiccation of vegetation and degradation of foraging/refugia and movement habitat.

All four project alternatives would have similar impacts on California red-legged frog because the portions of the project that would intersect habitat for the species have similar footprints. Work to construct Tunnels 1 and 2 (in the Morgan Hill and Gilroy and the Pacheco Pass Subsections, respectively) would have the greatest amount of impact on aquatic and upland habitat as well as critical habitat for the species, because the east and west portals of Tunnel 1 and the west portal of Tunnel 2 would be in the Wilson Peak Unit of designated critical habitat.

While pre-construction and construction actions to protect the California red-legged frog are part of the project, these actions would not prevent the conversion of habitat and temporary disturbance of other habitat in the project footprint. Because frogs can be distributed throughout suitable habitats, their exclusion from construction areas cannot be guaranteed. Earthmoving, excavation, and vehicle operation during construction could crush, entomb, or physically disturb individual frogs. Ground disturbance, noise, and vibration associated with these activities could disrupt the activities of individual frogs and may impair normal life cycle behaviors. If construction in the project footprint alters a hydrologic regime that supplies water to aquatic habitat features within 250 feet of the footprint, such hydrological modifications could indirectly affect habitat by altering the pools' ponding duration and rendering aquatic habitat unsuitable to support breeding behavior and the development of eggs and larvae. The use of chemicals and hazardous substances during construction (e.g., oils, gasoline) may cause mortality if individuals enter aquatic habitat that has been contaminated by accidental spills or other vehicle and equipment leaks. While many protections would be implemented, the potential for physical harm and mortality of individuals would not be eliminated.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both direct mortality and habitat modification, on the California red-legged frog. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in substantial loss and degradation of habitat and could cause injury or mortality of individuals. In the absence of mitigation, such impacts could reduce the viability of local populations and contribute to the rangewide decline of the species and could also impede recovery of the species into historical portions of its range. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#9: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Foothill Yellow-Legged Frog

Construction of the HSR track and systems in the Monterey Corridor, Morgan Hill and Gilroy, and Pacheco Pass Subsections would take place in suitable habitat for the foothill yellow-legged frog, a CDFW species of special concern, a candidate for state listing as threatened under CESA, and a species under review for federal listing under FESA. Such activities would convert habitat and reduce the quality of the remaining suitable habitat, and could result in the injury or mortality of individual yellow-legged frogs. The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#6, BIO-IAMF#7, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1 and Impact BIO#6) into project design to avoid and minimize impacts on foothill yellow-legged frog. Tunnels will be designed and constructed to avoid or minimize groundwater inflow into tunnels during construction that may affect surface water resources overlying the tunnel alignment (HYD-IAMF#5), including those that provide aquatic habitat for foothill yellow-legged frog.

The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat, injury and mortality of individuals) on breeding and foraging habitat for the species is shown in Table 3.7-13. All four project alternatives would have virtually identical impacts on habitat for this species, varying by only a very few acres, because the portions of the project that would intersect habitat for the species have similar footprints. Work to construct Tunnels 1 and 2 (in the Morgan Hill and Gilroy and the Pacheco Pass Subsections, respectively) would have the greatest amount of impact on aquatic and upland habitat.

The magnitude of permanent impacts by alternative would be, in descending order, 91.9 acres under Alternative 3, 91.7 acres under Alternative 1, 89.2 acres under Alternative 2, and 88.3 acres under Alternative 4. The extent of temporary impacts would be 42.0 acres under Alternative 2, 41.3 acres under Alternative 1, 41.0 acres under Alternative 3, and 39.4 acres under Alternative 4. The magnitude of indirect impacts (e.g., hydrologic modification, introduction of contaminants into watercourses), while not quantified through the modeling effort, would be generally proportional to the quantity of direct impacts. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without wetlands, waters, or habitat for foothill yellow-legged frog and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

As discussed in Impact BIO#1, construction of Tunnels 1 and 2 could have temporary indirect impacts on the hydrology of groundwater-dependent surface waters, including streams that provide aquatic habitat for foothill yellow-legged frog. Because foothill yellow-legged frogs require gently flowing water for breeding (Hayes et al. 2016: pages 5-6), any reductions in groundwater supply to occupied streams could result in mortality of eggs or larvae. If occupied streams become dry, juvenile and adult frogs would have to seek other aquatic habitat and individuals could be injured or killed during movement. Conversely, sudden discharges of groundwater inflows to occupied streams could remove egg masses attached to cobbles and boulders. Both impacts would reduce the reproductive success of the affected population.

While pre-construction and construction actions to protect the foothill yellow-legged frog are part of the project, these actions would not prevent the conversion of habitat and temporary disturbance of other habitat in the project footprint. Because frogs can be distributed throughout suitable habitats, their exclusion from construction areas cannot be guaranteed. Earthmoving, excavation, and vehicle operation during construction could crush, entomb, or physically disturb individual frogs. Ground disturbance, noise, and vibration associated with these activities could disrupt the activities of individual frogs and may impair normal life cycle behaviors. If construction in the project footprint alters a hydrologic regime, such hydrological modifications could indirectly affect habitat by altering the stream's flow regime and rendering aquatic habitat unsuitable to support breeding behavior and the development of eggs and larvae. The use of chemicals and hazardous substances during construction (e.g., oils, gasoline) may cause mortality if individuals

enter aquatic habitat that has been contaminated by accidental spills or other vehicle and equipment leaks. While many protections would be implemented, the potential for physical harm and mortality of individuals would not be eliminated.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both direct mortality and habitat modification, on the foothill yellow-legged frog. While actions would be implemented to reduce the potential for direct harm to individuals and to minimize the loss of habitat, in the absence of mitigation, the project could result in substantial loss and degradation of habitat and could cause injury or mortality of individuals. Such impacts could reduce the viability of local populations and contribute to the rangewide decline of the species. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#10: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Western Spadefoot

Construction of the HSR track and systems in the Morgan Hill and Gilroy, Pacheco Pass, and San Joaquin Valley Subsections would take place in suitable habitat for the western spadefoot, a CDFW species of special concern. Construction activities would convert suitable habitat and reduce the quality of the remaining suitable habitat, and could result in the injury or mortality of spadefoot individuals. The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#6, BIO-IAMF#7, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1 and Impact BIO#6) into project design to avoid and minimize impacts on western spadefoot.

The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat, injury and mortality of individuals) in breeding and nonbreeding habitat for the species is shown in Table 3.7-13. The four alternatives would have identical impacts on habitat for this species in the San Joaquin Valley Subsection and similar impacts (varying by only a few acres) in the San Jose Diridon Station Approach and Monterey Corridor Subsections. Alternative 2 would have the most extensive potential impact in the Morgan Hill and Gilroy Subsection because it would be largely on embankment, resulting in a larger project footprint and more ground disturbance.

The permanent and temporary impacts under Alternatives 1, 2, and 4 would be 528.7 acres and 212.1 acres, respectively. Alternative 4 would result in 760.9 acres and 214.7 acres, respectively. The magnitude of indirect impacts (e.g., hydrologic modification, introduction of contaminants into watercourses, introduction of invasive nonnative plant species), while not quantified through the modeling effort, would be generally proportional to the quantity of direct impacts. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without wetlands, waters, or habitat for western spadefoot and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

While pre-construction and construction actions to protect the western spadefoot are part of the project, these actions would not prevent the conversion of habitat and temporary disturbance of other habitat in the project footprint. Because spadefoots can be distributed throughout suitable habitats, their exclusion from construction areas cannot be guaranteed. Earthmoving, excavation, and vehicle operation during construction could crush, entomb, or physically disturb individual spadefoots. Ground disturbance, noise, and vibration associated with these activities could disrupt the activities of individuals and may impair normal life cycle behaviors. If construction in the project footprint alters a hydrologic regime, such hydrological modifications could indirectly affect habitat by altering the stream's flow regime or vernal pool's ponding duration and rendering aquatic habitat unsuitable to support breeding behavior and the development of eggs and larvae. The use of chemicals and hazardous substances during construction (e.g., oils, gasoline) may cause mortality if individuals enter aquatic habitat that has been contaminated by accidental spills

or other vehicle and equipment leaks. While many protections would be implemented, the potential for physical harm and mortality of individuals would not be eliminated.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both direct mortality and habitat modification, on the western spadefoot. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in substantial loss and degradation of habitat and could cause injury or mortality of individuals. Such impacts would reduce the viability of local populations and contribute to the rangewide decline of the species. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#11: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Western Pond Turtle

Construction of the HSR track and systems would take place in suitable habitat for the western pond turtle, a CDFW species of special concern. While suitable habitat is present in all five subsections, most of it occurs in the Morgan Hill and Gilroy, Pacheco Pass, and San Joaquin Valley Subsections. Construction activities would convert suitable habitat and reduce the quality of the remaining suitable habitat, and could result in the injury or mortality of individual pond turtles. The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#6, BIO-IAMF#7, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1 and Impact BIO#6) into project design to avoid and minimize impacts on western pond turtle. Tunnels will be designed and constructed to avoid or minimize groundwater inflows during construction that may affect surface water resources overlying the tunnel alignment (HYD-IAMF#5), including those that provide aquatic habitat for western pond turtle.

The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat, injury and mortality of individuals) in habitat for the species is shown in Table 3.7-13. The magnitude of permanent and temporary impacts by alternative would be, in descending order, 2,806.3 acres and 1,581.9 acres, respectively, under Alternative 2; 2,610.6 acres and 1,290.4 acres under Alternative 1; 2,545.4 acres and 1,266.1 acres under Alternative 3; and 2,461.6 and 1,055.6 acres under Alternative 4. The magnitude of indirect impacts (e.g., hydrologic modification, introduction of contaminants into watercourses), while not quantified through the modeling effort, would be generally proportional to the quantity of direct impacts. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without wetlands, waters, or habitat for western pond turtle and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

As discussed in Impact BIO#1, construction of Tunnels 1 and 2 could have temporary indirect impacts on the hydrology of groundwater-dependent surface waters, including those that provide aquatic habitat for western pond turtle. Because western pond turtles are associated with ponds or streams that hold water year-round, any reductions in groundwater supply to occupied ponds and streams could reduce the availability of foraging and basking habitat for the affected population. Sudden decreases in water levels could strand basking individuals, forcing them to move to other aquatic habitat, if any is available nearby.

While pre-construction and construction actions to protect the western pond turtle are part of the project, these actions would not prevent the conversion and temporary disturbance of suitable habitat in the project footprint. Because pond turtles can be distributed throughout suitable habitats and can aestivate in underground refugia, their exclusion from construction areas cannot be guaranteed. Earthmoving, excavation, and vehicle operation during construction could crush, entomb, or physically disturb individual turtles. Ground disturbance, noise, and vibration associated with these activities could disrupt the activities of individuals and may impair normal life cycle behaviors. If construction in the project footprint alters a hydrologic regime, such

hydrological modifications could indirectly affect habitat by rendering aquatic habitat unsuitable to support pond turtle populations. The use of chemicals and hazardous substances during construction (e.g., oils, gasoline) may cause mortality if individuals enter aquatic habitat that has been contaminated by spills or other vehicle and equipment leaks. While many protections would be implemented, the potential for physical harm and mortality of individuals would not be eliminated.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both direct mortality and habitat modification, on the western pond turtle. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in substantial loss and degradation of habitat and could cause injury or mortality of individuals. Such impacts would reduce the viability of local populations and contribute to the rangewide decline of the species. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#12: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Blunt-Nosed Leopard Lizard

Construction of the HSR track and systems in the eastern portion of the Pacheco Pass Subsection would take place in suitable habitat for blunt-nosed leopard lizard, a species listed as endangered under both FESA and CESA. Construction activities would convert habitat and reduce the quality of the remaining suitable habitat, and could result in the injury or mortality of individual leopard lizards. The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#6, BIO-IAMF#7, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1 and Impact BIO#6) into project design to avoid and minimize impacts on blunt-nosed leopard lizard.

The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat, injury and mortality of individuals) in suitable habitat for the species is shown in Table 3.7-13. Because the only suitable habitat for this species occurs in the Pacheco Pass and San Joaquin Valley Subsections, where all four project alternatives would be identical, the impacts would similarly be identical, concentrated in the area east of Tunnel 2. The project would result in permanent and temporary impacts on 477.1 and 219.2 acres of potentially suitable habitat, respectively. The magnitude of indirect impacts (e.g., topographic modification, introduction of contaminants into habitat, introduction of nonnative plant species), while not quantified through the modeling effort, would be generally proportional to the quantity of direct impacts. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without wetlands, waters, or habitat for blunt-nosed leopard lizard and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

While pre-construction and construction actions to protect the blunt-nosed leopard lizard are part of the project, these actions would not prevent the conversion and temporary disturbance of suitable habitat in the project footprint. Because leopard lizards can be distributed throughout suitable habitats and primarily occur underground, their exclusion from work areas cannot be guaranteed. Grading, excavation, and vehicle movement could kill individuals on the surface and could crush adults or eggs in underground refugia. Lizards that fall into uncovered trenches, pits, or other excavations could die from desiccation, entombment, or starvation. Lizards that enter habitat where toxic substances have been accidentally discharged could be poisoned either directly or through eating contaminated prey. The introduction of nonnative plants could render habitat less suitable for leopard lizard occupancy. While some protections will be implemented, the potential for physical harm and mortality of individuals will not be eliminated, and therefore additional mitigation measures will be required to avoid take of this species.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both direct mortality and habitat modification, on the blunt-nosed leopard lizard. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in loss and degradation of habitat and could cause injury or mortality of individuals. Such impacts would reduce the viability of local populations and contribute to the rangewide decline of the species and could also impede recovery of the species in historical portions of its range. Mitigation measures to address this impact and avoid take of this fully protected species are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#13: Permanent Conversion or Degradation of Habitat for and Direct Mortality of San Joaquin Coachwhip, Northern California Legless Lizard, and Coast Horned Lizard

Construction of the HSR track and systems in the eastern portion of the Morgan Hill and Gilroy Subsection and throughout the Pacheco Pass Subsection would take place in suitable habitat for San Joaquin coachwhip, northern California legless lizard, and coast horned lizard, all of which are CDFW species of special concern. Construction activities would convert suitable habitat and reduce the quality of the remaining habitat, and could result in the injury or mortality of individuals of all three species. The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#6, BIO-IAMF#7, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1 and Impact BIO#6) into project design to avoid and minimize impacts on San Joaquin coachwhip, northern California legless lizard, and coast horned lizard.

The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat, injury and mortality of individuals) on suitable habitat for these species is shown in Table 3.7-13. Because the only habitat for these species occurs in the Morgan Hill and Gilroy and Pacheco Pass Subsections, in areas where all four project alternatives are identical, the impacts would be identical. The permanent and temporary impacts would be 992.9 acres and 279.7 acres, respectively. The magnitude of indirect impacts (e.g., topographic modification, introduction of contaminants into habitat, introduction of nonnative plant species), while not quantified through the modeling effort, would be generally proportional to the quantity of direct impacts.

All four project alternatives would have similar impacts on each of these species because the portions of the project that would intersect habitat for the species have identical footprints. Work to construct Tunnels 1 and 2 (in the Morgan Hill and Gilroy and the Pacheco Pass Subsections, respectively) would have the greatest amount of impact on suitable habitat for San Joaquin coachwhip and coast horned lizard; work to construct Tunnel 1 and the western portal for Tunnel 2 would have the greatest amount of impact on suitable habitat for northern California legless lizard. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

While pre-construction and construction actions to protect special-status reptiles are part of the project, these actions would not prevent the conversion and temporary disturbance of suitable habitat in the project footprint. Because coachwhips and horned lizards can move through small openings and can take refuge in burrows and under surface objects, and because legless lizards are primarily subterranean, their exclusion from work areas cannot be guaranteed. Grading, excavation, and vehicle movement could kill individuals on the surface and could crush adults or eggs in underground refugia. Reptiles that fall into uncovered trenches, pits, or other excavations could die from desiccation, entombment, or starvation. Reptiles that enter habitat where toxic substances have been accidentally discharged could be poisoned either directly or through eating contaminated prey. The introduction of nonnative plants could render habitat less suitable for occupancy. While many protections would be implemented, the potential for physical harm and mortality of individuals would not be eliminated.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both direct mortality and habitat modification, on San Joaquin coachwhip, northern California legless lizard, and coast horned lizard. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in loss and degradation of habitat and could cause injury or mortality of individuals. Such impacts would reduce the viability of local populations and contribute to rangewide declines of these species. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#14: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Giant Garter Snake

Construction of the HSR track and systems in the eastern portion of the Pacheco Pass and the San Joaquin Valley Subsections would take place in suitable habitat for the giant garter snake, a species listed as threatened under both FESA and CESA. Construction activities would convert and disturb suitable habitat and could reduce the quality of remaining suitable habitat, and could result in the injury or mortality of individual giant garter snakes. The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#6, BIO-IAMF#7, BIO-IAMF#8, and BIO-IAMF#11 (described in Impact BIO#1 and Impact BIO#6) into project design to avoid and minimize impacts on giant garter snake.

The areal extent of direct permanent and temporary impacts (conversion and disturbance of aquatic and upland habitat, injury and mortality of individuals) in habitat for giant garter snake is shown in Table 3.7-13. Because suitable habitat occurs only in the two subsections where all four alternatives follow identical alignments and profiles, the impacts would be identical. The magnitude of permanent and temporary impacts would be 385.4 acres and 182.6 acres, respectively. The magnitude of indirect impacts (e.g., hydrologic modification, downstream impacts of dewatering or diversion, introduction of contaminants into habitat), while not quantified through the modeling effort, would be generally proportional to the quantity of direct impacts. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

While pre-construction and construction actions to protect giant garter snakes are part of the project, these actions would not prevent the conversion and temporary disturbance of suitable habitat in the project footprint. Most impacts would occur in upland habitat, which is more abundant in the project footprint than aquatic habitat. Most impacts on aquatic habitat would be associated with construction of stream crossings. Because garter snakes can move through small openings and take refuge in burrows, their exclusion from work areas cannot be guaranteed. Grading, excavation, and vehicle movement could kill individuals on the surface and could crush snakes in underground refugia. Garter snakes that fall into uncovered trenches, pits, or other excavations could die from entombment or starvation. Snakes that enter habitat where toxic substances have been accidentally discharged could be poisoned either directly or through eating contaminated prey. Dewatering or diversion of waterbodies could reduce availability and quality of habitat both where work is underway and downstream.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both direct mortality and habitat modification, on giant garter snake. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in loss and degradation of habitat and could cause injury or mortality of individuals. Such impacts would reduce the viability of local populations and contribute to the rangewide decline of the species, and could also impede recovery of the species in historical portions of its range. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#15: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Short-Eared Owl and Grasshopper Sparrow

Construction of the HSR track and systems in the Pacheco Pass and San Joaquin Valley Subsections would take place in suitable habitat for short-eared owl and grasshopper sparrow, both of which are CDFW species of special concern. Habitat for grasshopper sparrow also occurs in the eastern portion of the Morgan Hill and Gilroy Subsection. Construction activities would convert and temporarily disturb suitable habitat and could result in injury and mortality of individual birds and eggs, as well as nest abandonment. Temporarily disturbed areas may be susceptible to increased cover of tall invasive weeds with thick stems and dense growth (e.g., thistles, mustard, perennial pepperweed), which would reduce the herbaceous ground cover preferred for nesting by these species.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#8, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1) into project design to avoid and minimize impacts on short-eared owl and grasshopper sparrow. The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat, injury and mortality of individuals) on habitat for these two ground-nesting species is shown in Table 3.7-13. Because most suitable habitat occurs only in the two subsections where all four alternatives follow identical alignments and profiles, the impacts would be nearly identical. The magnitude of permanent and temporary impacts would be 1,043.1 acres and 417.7 acres, respectively. (Alternative 3 would result in 0.1 acre less of temporary impact on habitat for grasshopper sparrow.) The magnitude of indirect impacts (e.g., introduction of invasive nonnative plant species), while not quantified through the modeling effort, would be generally proportional to the quantity of direct impacts. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

While pre-construction and construction actions to minimize impacts on short-eared owl and grasshopper sparrow habitat are part of the project, these actions would not prevent the conversion and temporary disturbance of suitable habitat in the project footprint, nor would they eliminate the risk of injury, mortality, and disturbance of individual birds. Ground disturbance (e.g., grubbing during site preparation) in suitable nesting habitat for these species could crush eggs or kill nestlings in active nests. Construction-generated noise and vibration near active nests could cause adults to abandon eggs or recently hatched young if they perceive such disturbances as a threat. Artificial lighting of nighttime construction activities near active nests could also potentially cause nest abandonment. Cleaning of construction equipment may not entirely prevent invasive plants from spreading into the habitat study area.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both direct mortality and habitat modification, on short-eared owl and grasshopper sparrow. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in substantial loss and degradation of habitat for both species, could result in the destruction of active nests, and could cause nest abandonment through noise- and vibration-related disturbance beyond the project footprint. These impacts would reduce the viability of local populations and contribute to rangewide declines of these species. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#16: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Mountain Plover and Western Snowy Plover (Interior Population)

Construction of the HSR track and systems in the San Joaquin Valley Subsection would take place in suitable habitat for mountain plover and western snowy plover (interior population), both of which are CDFW species of special concern. Suitable habitat for mountain plover also occurs at the eastern end of the Pacheco Pass Subsection. Construction activities would convert and temporarily disturb habitat and could result in injury and mortality of individual western snowy plovers and their eggs, as well as nest abandonment. Mountain plovers do not breed in

California; they occur September to mid-March (with peak numbers from December through February). Construction activities could result in loss or conversion of mountain plover habitat, as well as disturbance of wintering individuals. Increased cover of invasive weeds would degrade habitat for both species because both prefer areas with short, sparse, or no vegetation.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#8, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1) into project design to avoid and minimize impacts on mountain plover and western snowy plover (interior population). The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat; disturbance, injury, and mortality of individuals) on habitat for these two species is shown in Table 3.7-13. Because suitable habitat occurs only in the two subsections where all four alternatives follow identical alignments and profiles, the impacts would be identical. The magnitude of permanent and temporary impacts would be 613.5 acres and 329.2 acres, respectively. The magnitude of indirect impacts (introduction of invasive nonnative plant species that would degrade habitat), while not quantified through the modeling effort, would be generally proportional to the quantity of direct impacts. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

While pre-construction and construction actions to minimize impacts on mountain plover and western snowy plover habitat are part of the project, these actions would not prevent the conversion and temporary disturbance of suitable habitat in the project footprint, nor would they eliminate the risk of disturbance of individual birds. Construction activities in the San Joaquin Valley Subsection and at the eastern end of the Pacheco Pass Subsection from September to mid-March could cause mountain plovers resting or foraging in affected agricultural and grassland habitat to flee if they perceive such activities as a threat. Artificial lighting of nighttime construction activities could also disturb roosting plovers. While such disturbance would not kill or injure the birds, they would consume more energy flying and searching for food than they would in the absence of such disturbance. Construction-generated noise and vibration near active western snowy plover nests could cause nest abandonment, which could reduce breeding success of the local population of western snowy plover. Artificial lighting of nighttime construction activities near active nests could also potentially cause nest abandonment. Cleaning of construction equipment may not entirely prevent invasive plants from spreading into the habitat study area.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both disturbance of individuals and habitat modification, on mountain plover and the interior population of western snowy plover. While actions would be implemented before and during construction to reduce the potential for disturbance of individuals and minimize the loss of habitat, the project would result in loss and degradation of habitat for both species as well as noise- and vibration-related disturbance beyond the project footprint. In the absence of mitigation, such impacts would reduce the viability of local snowy plover populations and impair the energy budget of mountain plovers during their wintering period, contributing to rangewide declines of these species. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#17: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Burrowing Owl

Construction of the HSR track and systems in all five subsections would take place in suitable habitat for the burrowing owl, a CDFW species of special concern. Most impacts would occur in the Morgan Hill and Gilroy, Pacheco Pass, and San Joaquin Valley Subsections. Construction activities would convert and temporarily disturb habitat and could result in injury and mortality of individual owls and eggs, as well as nest abandonment. Ground disturbance and vehicle traffic could injure or kill burrowing owls by crushing occupied burrows or collapsing burrow entrances, trapping any owls inside. Although some burrowing owls in urban and agricultural landscapes appear relatively tolerant of human disturbance (Poulin et al. 2011), it is difficult to predict how

and at what distance a given nesting pair would react to noise and vibration. Consequently, it is possible that construction-generated noise and vibration near nest burrows could cause adult owls to abandon eggs or recently hatched young. Artificial lighting of nighttime construction activities near active nest burrows could also potentially cause nest abandonment. Increased cover of invasive weeds could reduce habitat suitability for burrowing owls because they prefer areas with short, sparse vegetation (CDFG 2012).

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#8, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1) into project design to avoid and minimize impacts on burrowing owl. The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat; disturbance, injury, and mortality of individuals) on breeding and foraging habitat for burrowing owl is shown in Table 3.7-13. The four alternatives would have identical impacts on habitat in the Pacheco Pass and San Joaquin Valley Subsections. Alternatives 2 and 3 would have broadly similar impacts on habitat for this species in the remaining subsections. Alternative 1 would affect a similar amount of habitat as Alternatives 2 and 3 in the San Jose Diridon Station Approach and Monterey Corridor Subsections, but would affect less habitat in the Morgan Hill to Gilroy Subsection because of the increased extent of viaduct that would result in less ground disturbance. Alternative 4 would affect the least amount of habitat because of its reduced footprint. The magnitude of permanent impacts by alternative would be, in descending order, 1,694.3 acres under Alternative 3; 1,649.8 acres under Alternative 2; 1,541.5 acres under Alternative 1; and 1,464.7 acres under Alternative 4. The magnitude of temporary impacts by alternative would be, in descending order, 791.3 acres under Alternative 2, 672.0 acres under Alterative 3, 635.3 acres under Alternative 1, and 549.9 acres under Alternative 4. The magnitude of indirect impacts (introduction of invasive nonnative plant species), while not quantified through the modeling effort, would be generally proportional to the quantity of direct impacts. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without wetlands, waters, or habitat for burrowing owl and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

While pre-construction and construction actions to minimize impacts on burrowing owl habitat are part of the project, these actions would not prevent the conversion and temporary disturbance of suitable habitat in the project footprint, nor would they eliminate the risk of injury, mortality, and disturbance of individual owls.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both direct mortality and disturbance of individuals and habitat modification, on burrowing owl. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in substantial loss and degradation of habitat for a population that has already experienced considerable decline in the South San Francisco Bay area, could result in the destruction of active nests, and could cause nest abandonment through noise- and vibration-related disturbance beyond the project footprint. The loss of even a few adults from the dwindling South Bay population would be a substantial impact because reductions in adult survival may contribute to long-term population declines for this species (Barclay et al. 2011). Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#18: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Golden Eagle and Bald Eagle

Construction of the HSR track and systems in all five subsections would take place in suitable habitat for both bald and golden eagles. The bald eagle is listed as endangered under CESA; both species are fully protected under Cal. Fish and Game Code and both are protected under the BGEPA. Construction activities would convert and temporarily disturb habitat and could result in disturbance, injury, or mortality of nesting eagles if any are present in the vicinity.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, and BIO-IAMF#8 (described in Impact BIO#1) into project design to avoid and minimize impacts on bald and golden eagles. The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat, disturbance of individuals) on nesting and foraging habitat for both species is shown in Table 3.7-13. The aggregate (nonoverlapping) extent of permanent impacts by alternative would be, in descending order, 1,193.2 acres under Alternative 2; 1,179.8 acres under Alternative 1; 1,169.4 acres under Alternative 3; and 1,141.5 acres under Alternative 4. The extent of temporary impacts would be 525.4 acres under Alternative 2, 504.7 acres under Alternative 3, 499.0 acres under Alternative 1, and 469.6 acres under Alternative 4. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without wetlands, waters, or habitat for golden eagle and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

While pre-construction actions to minimize impacts on bald and golden eagles and their habitat are part of the project, these actions would not prevent the conversion and temporary disturbance of habitat in the project footprint, nor would they eliminate the risk of removing active eagle nests or disturbing nesting eagles in the vicinity if any are present in sight or hearing range of construction activities. Although there were no known eagle nests in the habitat study area at the time this analysis was conducted, construction would take place in nesting habitat for both species. There is wide variation in reported distances at which raptors are disturbed by human activities (PG&E 2016: page 4-4 For the purpose of this analysis and based on previous buffers for these species recommended by the USFWS (2007, 2013a), any bald or golden eagles nesting within 0.5 mile of the project footprint (generally, topography that blocks line of sight could shorten this typical distance) could be disturbed by construction noise or vibration, potentially causing nest abandonment. Artificial lighting of nighttime construction activities near active nests could also potentially cause nest abandonment.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both direct mortality or disturbance of individuals and habitat modification, on bald and golden eagles. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of suitable habitat, the project would result in loss and degradation of habitat for both species, could result in the destruction of active nests, and could cause nest abandonment through noise- and vibration-related disturbance beyond the project footprint. The loss of eagle nests would be a substantial impact because eagles have a low reproductive rate and the loss of eggs or young could result in population decline. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#19: Injury or Disturbance of California Condor

Construction of the HSR track and systems at the eastern end of the Morgan Hill and Gilroy Subsection and in the Pacheco Pass Subsection would take place within the range of California condor (USFWS 2019a). Construction activities could result in injury or disturbance of condors if any are present in the vicinity.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, and BIO-IAMF#8 (described in Impact BIO#1) into project design to avoid and minimize impacts on California condor. The likelihood of injuring or disturbing condors would be identical for all four alternatives because of their identical footprints at the eastern end of the Morgan Hill and Gilroy Subsection and in the Pacheco Pass Subsection. Habitat was not modeled for this species because any natural cover types in the Diablo Range could theoretically be used for foraging. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

While pre-construction actions to minimize impacts on special-status species and their habitat are part of the project, these actions would not eliminate the risk of injuring or disturbing condors in the vicinity if any are foraging over or roosting in sight or hearing range of construction activities. Although there were no known condor roosts in the habitat study area at the time this analysis was conducted, construction would take place near suitable roosting habitat (e.g., Lover's Leap south of SR 152). For the purpose of this analysis, it is assumed that any condors roosting within 0.5 mile of the project footprint (topography that blocks line of sight could shorten this distance) could be disturbed by construction noise or vibration, potentially causing roost abandonment. Artificial lighting of nighttime construction activities near active roost sites could also potentially cause roost abandonment. Construction materials (i.e., ropes and cables) as well as permanent wires associated with the overhead contact system (OCS) and new power lines, would pose a hazard to any foraging condors because they could become entangled in the wires. If left untended on the landscape, "microtrash" (e.g., broken glass, bottle caps, can tabs, nuts, bolts, screws) generated during construction could be ingested by adult condors or carried to distant nest sites by adults and fed to chicks. Such microtrash could get stuck in the gastrointestinal tract of condors and cause impaction, resulting in starvation and death (USFWS 2016c).

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through direct mortality or disturbance of individuals, on California condor. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals, the project could cause roost abandonment through noise- and vibration-related disturbance beyond the project footprint, injury of adults through entanglement in new electrical lines, and mortality of adults and chicks through ingestion of trash generated by construction. The loss of a single condor from the state population would be a substantial impact because condors have a low reproductive rate and a limited number of condors are released into the wild from the USFWS' captive rearing program. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation measures, describes these measures in detail.

Impact BIO#20: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Special-Status Raptors (American Peregrine Falcon, Northern Harrier, White-Tailed Kite) and Other Raptors

Construction of the HSR track and systems in all five subsections would take place in suitable habitat for three special-status raptor species: American peregrine falcon, northern harrier, and white-tailed kite. Peregrine falcon and white-tailed kite are California fully protected species, and northern harrier is a California species of special concern. Moreover, the same habitat is also suitable to support other raptors (e.g., red-tailed hawk and Cooper's hawk), collectively referred to as "raptors" in this impacts discussion. Construction activities would convert and temporarily disturb suitable habitat and could result in disturbance, injury, or mortality of nesting raptors if any are present in the vicinity.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, and BIO-IAMF#8 (described in Impact BIO#1) into project design to avoid and minimize impacts on special-status and other raptors. The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat, disturbance of individuals) on habitat for the three special-status raptors is shown in Table 3.7-13. The aggregate magnitude of permanent and temporary impacts by alternative would be, in descending order, 6,426.4 acres and 3,526.1 acres, respectively, under Alternative 2; 6,359.4 acres and 2,897.6 acres under Alternative 3; 6,151.5 acres and 2,819.5 acres under Alternative 1; and 5,723.2 acres and 2,368.3 acres under Alternative 4. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without habitat for special-status raptors and other raptors and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

While pre-construction actions to minimize impacts on special-status raptors and their habitat are part of the project, these actions would not prevent the conversion and temporary disturbance of habitat in the project footprint, nor would they necessarily eliminate the risk of removing active raptor nests or disturbing nesting raptors in the vicinity if any are present in sight or hearing range of construction activities. There is wide variation in reported distances at which raptors are disturbed by human activities (PG&E 2016: page 4-4), making broad generalizations about disturbance distances difficult. For the purpose of this analysis and based on typical guidance on disturbance distances from CDFW, any raptors nesting within 500 feet of the project footprint (i.e., habitat study area) could potentially be disturbed by construction noise or vibration, potentially causing nest abandonment. Artificial lighting of nighttime construction activities near active nests could also potentially cause nest abandonment.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both direct mortality or disturbance of individuals and habitat modification, on American peregrine falcon, northern harrier, white-tailed kite, and non-special-status raptors. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in loss and degradation of habitat for all three species, could result in the destruction of active nests, and could cause nest abandonment through noise- and vibration-related disturbance beyond the project footprint. The loss of raptor nests would be a substantial impact because raptors have low reproductive rates and loss of eggs or young would reduce the viability of local populations and could result in rangewide population declines. Mitigation measures to address this impact and avoid take of fully protected species are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#21: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Swainson's Hawks

Construction of the HSR track and systems in all subsections except the San Jose Diridon Station Approach Subsection would take place in suitable habitat for the Swainson's hawk, a species listed as threatened under CESA. Construction activities would convert and temporarily disturb habitat and could result in disturbance, injury, or mortality of nesting Swainson's hawks if any are present in the vicinity.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, and BIO-IAMF#8 (described in Impact BIO#1) into project design to avoid and minimize impacts on Swainson's hawk. The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat, disturbance of individuals) on nesting and foraging habitat for Swainson's hawk is shown in Table 3.7-13. The four alternatives would have broadly similar impacts on suitable habitat; impacts would be identical under Alternatives 1 and 3. The magnitude of permanent and temporary impacts by alternative in descending order would be 1,045.1 acres and 698.4 acres, respectively, under Alternative 2; 955.5 acres and 578.9 acres under Alternatives 1 and 3; and 939.1 acres and 541.7 acres under Alternative 4. The more extensive impacts under Alternative 2 would result from its alignment through more agricultural lands in the Monterey Corridor and Morgan Hill and Gilroy Subsections than Alternatives 1, 3, and 4. Most of the active nesting habitat in the habitat study area is in the San Joaquin Valley Subsection, including several nests along Henry Miller Road. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

While pre-construction actions to minimize impacts on Swainson's hawks and their habitat are part of the project, these actions would not prevent the conversion and temporary disturbance of suitable habitat in the project footprint, nor would they eliminate the risk of removing active Swainson's hawk nests or disturbing nesting Swainson's hawks in the vicinity if any are present in sight or hearing range of construction activities. For the purpose of this analysis, any Swainson's hawks nesting within 0.5 mile of the project footprint (i.e., habitat study area) could potentially be

disturbed by construction noise or vibration, potentially causing nest abandonment. Artificial lighting of nighttime construction activities near active nests could also potentially cause nest abandonment.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both direct mortality or disturbance of individuals and habitat modification, on the Swainson's hawk. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in loss and degradation of habitat, could result in the destruction of active nests, and could cause nest abandonment through noise- and vibration-related disturbance beyond the project footprint. The loss of Swainson's hawk nests would be a substantial impact because this species has a low reproductive rate and loss of eggs or young would reduce the viability of the San Joaquin Valley population and contribute to the statewide decline of this species. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#22: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Purple Martin, Olive-Sided Flycatcher, and Loggerhead Shrike

Construction of the HSR track and systems in all five subsections would take place in suitable habitat for three special-status tree-nesting species: purple martin, olive-sided flycatcher, and loggerhead shrike, all of which are CDFW species of special concern. Nesting habitat for purple martin and olive-sided flycatcher is limited to the Pacheco Pass Subsection. Construction activities would convert and temporarily disturb suitable habitat and could result in disturbance, injury, or mortality of nesting birds and the destruction of eggs and nests.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, and BIO-IAMF#8 (described in Impact BIO#1) into project design to avoid and minimize impacts on purple martin, olive-sided flycatcher, and loggerhead shrike. The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat, disturbance of individuals) in habitat for these species is shown in Table 3.7-13. All four project alternatives would have similar impacts on purple martin and olive-sided flycatcher because habitat for those two species is present only in the Pacheco Pass Subsection, where all four alternatives would be identical, with a small amount of habitat at the extreme southeastern edge of the Morgan Hill and Gilroy Subsection. The aggregate extent of permanent impacts by alternative would be, in descending order, 2,478.7 acres under Alternative 3; 2,391.7 acres under Alternative 2; 2,334.3 acres under Alternative 1; and 2,171.5 acres under Alternative 4. The extent of temporary impacts by alternative would be, in descending order, 1,144.1 acres under Alternative 2; 993.0 acres under Alternative 3; 941.5 acres under Alternative 1; and 857.7 acres under Alternative 4. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without habitat for purple martin, olive-sided flycatcher, and loggerhead shrike and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives and thus would not change construction effects on any biological resources. While pre-construction actions to minimize impacts on purple martin, olive-sided flycatcher, and loggerhead shrike and their habitat are part of the project, these actions would not prevent the conversion and temporary disturbance of suitable habitat in the project footprint, nor would they eliminate the risk of injury, mortality, and disturbance of nesting birds. Ground-disturbing activities (e.g., grubbing and vegetation removal during site preparation) in suitable nesting habitat could crush eggs or kill nestlings in active nests. Construction-generated noise and vibration near active nests could cause nest abandonment. Artificial lighting of nighttime construction activities near active nests could also potentially cause nest abandonment.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both direct mortality or disturbance of individuals and

habitat modification, on loggerhead shrike, purple martin, and olive-sided flycatcher. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss habitat, the project would result in loss and degradation of habitat, could result in the destruction of active nests, and could cause nest abandonment through noise- and vibration-related disturbance beyond the project footprint. These impacts would reduce the viability of local populations and contribute to the statewide decline of these species. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#23: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Least Bell's Vireo, Yellow Warbler, and Yellow-Breasted Chat

Construction of the HSR track and systems would take place in suitable habitat for three special-status riparian species: least Bell's vireo, yellow warbler, and yellow-breasted chat. Least Bell's vireo is listed as endangered under the FESA and CESA; yellow warbler and yellow-breasted chat are CDFW species of special concern. Although habitat is present in all five subsections, the highest quality habitat occurs in the Morgan Hill and Gilroy and Pacheco Pass Subsections. Construction activities would convert and temporarily disturb suitable habitat and could result in disturbance, injury, or mortality of nesting birds and the destruction of eggs and nests. Ground disturbance and vegetation removal in riparian habitat would create areas of bare soil susceptible to colonization by nonnative invasive plant species such as giant reed, tamarisk, and perennial pepperweed. Dense stands of these species would degrade riparian habitat for least Bell's vireos and other riparian birds by outcompeting willows and other native plants that provide nest sites.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#8, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1) into project design to avoid and minimize impacts on least Bell's vireo, yellow warbler, and yellow-breasted chat. The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat; disturbance, injury, and mortality of individuals) in habitat for the three special-status riparian birds is shown in Table 3.7-13. Tunnels will be designed and constructed to avoid or minimize groundwater inflow into tunnels during construction that may affect surface water resources overlying or near the tunnel alignment (HYD-IAMF#5), including riparian habitat for least Bell's vireo and other riparian birds.

The aggregate extent of permanent impacts by alternative is broadly similar for all alternatives and would be, in descending order, 131.6 acres under Alternative 3; 128.5 acres under Alternative 2; 126.2 acres under Alternative 1; and 117.5 acres under Alternative 4. The extent of temporary impacts would be, in descending order, 98.1 acres under Alternative 2; 94.3 acres under Alternative 1; 88.9 acres under Alternative 3; and 77.2 acres under Alternative 4. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without habitat for least Bell's vireo, yellow warbler, and yellow-breasted chat and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives and thus would not change construction effects on any biological resources. As discussed in Impact BIO#1, construction of Tunnels 1 and 2 could have temporary indirect impacts on the hydrology of groundwater-dependent surface water features, including riparian vegetation along Pacheco Creek that provides habitat for least Bell's vireo and other riparian birds. Reductions in groundwater supply to riparian vegetation could result in the desiccation of vegetation and degradation of habitat for these species.

While pre-construction and construction actions to minimize impacts on least Bell's vireo, yellow warbler, and yellow-breasted chat and their habitat are part of the project, these actions would not prevent the conversion and temporary disturbance of suitable habitat in the project footprint, nor would they eliminate the risk of injury, mortality, and disturbance of nesting birds. Ground-disturbing activities (e.g., grubbing and vegetation removal during site preparation) in suitable nesting habitat could crush eggs or kill nestlings in active nests if not found during pre-construction surveys. Construction-generated noise and vibration near active nests could cause

nest abandonment. Artificial lighting of nighttime construction activities near active nests could also potentially cause nest abandonment. Cleaning of construction equipment may not entirely eliminate invasive plants from the habitat study area.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both direct mortality and disturbance of individuals and habitat modification, on least Bell's vireo, yellow warbler, and yellow-breasted chat. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in loss and degradation of habitat for these species, could result in the destruction of active nests, and could cause nest abandonment through noise- and vibration-related disturbance beyond the project footprint. These impacts would reduce the viability of local populations and contribute to rangewide declines of these species, and could also impede recovery of least Bell's vireo in historical portions of its range. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#24: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Tricolored Blackbird and Yellow-Headed Blackbird

Construction of the HSR track and systems in all five subsections would take place in suitable habitat for two special-status marsh birds: tricolored blackbird and yellow-headed blackbird. Nesting habitat for yellow-headed blackbird is limited to the San Joaquin Valley Subsection. Construction activities would convert and temporarily disturb habitat and could result in disturbance, injury, or mortality of nesting birds and the destruction of eggs and nests.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#8, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1) into project design to avoid and minimize impacts on tricolored blackbird and yellow-headed blackbird. Tunnels will be designed and constructed to avoid or minimize groundwater inflows into tunnel during construction that may affect surface water resources overlying the tunnel alignment (HYD-IAMF#5), including those that provide nesting habitat for tricolored blackbird.

The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat, disturbance of individuals) in habitat for the two special-status marsh birds is shown in Table 3.7-13. The aggregate extent of permanent impacts by alternative would be, in descending order, 1,925.5 acres under Alternative 3; 1,877.0 acres under Alternative 2; 1,763.8 acres under Alternative 1; and 1,682.8 acres under Alternative 4. The extent of temporary impacts by alternative would be, in descending order, 1,040.6 acres under Alternative 2; 921.7 acres under Alternative 3; 877.2 acres under Alternative 1; and 826.0 acres under Alternative 4. The magnitude of indirect impacts (introduction of invasive nonnative plant species), while not quantified through the modeling effort, would be generally proportional to the quantity of direct impacts. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without habitat for tricolored blackbird and yellow-headed blackbird and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

As discussed in Impact BIO#1, construction of Tunnels 1 and 2 could have temporary indirect impacts on the hydrology of groundwater-dependent surface waters, including ponds and wetlands that may support freshwater emergent vegetation suitable for nesting by tricolored blackbirds. Any reductions in groundwater supply to such ponds and wetlands could result in the gradual desiccation of emergent vegetation, reducing or eliminating suitable nesting habitat in subsequent nesting seasons.

While pre-construction and construction actions to protect special-status marsh birds are part of the project, these actions would not prevent the conversion and temporary disturbance of suitable habitat in the project footprint, nor would they necessarily eliminate the risk of injury, mortality,

and disturbance of nesting birds. Ground-disturbing activities (e.g., grubbing and vegetation removal during site preparation) in suitable nesting habitat could crush eggs or kill nestlings in active nests. Construction-generated noise and vibration near active nests could cause nest abandonment. Artificial lighting of nighttime construction activities near active nests could also potentially cause nest abandonment. Additionally, increased cover of invasive weeds (e.g., perennial pepperweed) in wetlands could reduce emergent wetland vegetation that provides cover for nesting by these species.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through both direct mortality or disturbance of individuals and habitat modification, on tricolored blackbird and yellow-headed blackbird. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in loss and degradation of habitat for these species, could result in the destruction of active nests, and could cause nest abandonment through noise- and vibration-related disturbance beyond the project footprint. These impacts would reduce the viability of local populations and contribute to the rangewide decline of these species. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#25: Permanent Conversion or Degradation of Habitat for and Disturbance of Sandhill Crane

Construction of the HSR track and systems in the San Joaquin Valley Subsection would take place in suitable habitat for sandhill crane. The greater subspecies is listed as endangered under CESA and is fully protected under the Cal. Fish and Game Code; the lesser subspecies is a CDFW species of special concern. Construction activities would convert and temporarily disturb habitat and could result in disturbance of roosting and foraging cranes.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#8, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1) into project design to avoid and minimize impacts on sandhill crane. The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat, disturbance of individuals) in roosting and foraging habitat for sandhill crane is shown in Table 3.7-13. The impacts would be identical for all four project alternatives because the alternatives would be the same in the San Joaquin Valley Subsection. The magnitude of permanent and temporary impacts would be 382.3 acres and 286.9 acres, respectively. The magnitude of indirect impacts (introduction of invasive nonnative plant species), while not quantified through the modeling effort, would be generally proportional to the quantity of direct impacts. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

While pre-construction and construction actions to minimize impacts on sandhill cranes and their habitat are part of the project, these actions would not prevent the conversion and temporary disturbance of suitable habitat in the project footprint, nor would they necessarily eliminate the risk of disturbance of foraging and roosting cranes. Construction activities from October to mid-March could cause sandhill cranes resting or foraging in nearby agricultural and grassland habitat to flee if they perceive such activities as a threat. Artificial lighting of nighttime construction activities could also disturb roosting plovers. While such disturbance would not kill or injure individual cranes, they would consume more energy flying and searching for food than they would in the absence of such disturbance. Additionally, increased cover of invasive weeds (e.g., thistles, mustard, perennial pepperweed) in grassland or wetlands would degrade habitat the sandhill crane because invasive plants have been shown to adversely affect roosting habitat in other portions of its range (Kessler et al. 2011).

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could result in a substantial adverse effect, through both disturbance of individuals and habitat modification, on greater sandhill crane and lesser sandhill crane. While actions would be

implemented before and during construction to reduce the potential for direct harm to individuals and minimize the loss of habitat, the project would result in loss and degradation of habitat for these subspecies as well as noise- and vibration-related disturbance beyond the project footprint. These impacts could adversely affect the energy budget of wintering sandhill cranes, potentially reducing the viability of migratory populations and contributing to rangewide declines of these subspecies. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#26a: Loss of Breeding, Foraging, and Dispersal Habitat for and Direct Mortality or Disturbance of Mountain Lion

Construction of the HSR track and systems in all subsections would take place in suitable habitat for mountain lion, a population of which is a candidate for listing under CESA (potential habitat for the population that is a candidate for listing only extends into the San Joaquin Valley Subsection as far as the eastern slope of the Diablo Range and excludes most of the San Joaquin Valley Subsection within the Central Valley). Construction activities would convert and temporarily disturb habitat and could result in the disturbance, injury, and mortality of individual mountain lions.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#7, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1 and Impact BIO#6) into project design to avoid and minimize impacts on wildlife and plants from construction. As these IAMFs are widely applicable to all species, they will also avoid and minimize impacts on mountain lion. The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat; disturbance, injury, and mortality of individuals) in habitat for mountain lion is shown in Table 3.7-13. In the Pacheco Pass and San Joaquin Valley Subsections, because the alternatives would be identical, the impacts would also be identical. In the Morgan Hill and Gilroy Subsection, there would be a minimal difference between Alternative 3 and Alternatives 1, 2, and 4 associated with the alignment of Alternative 3 through east Gilroy. While the project would result in the loss or disturbance of foraging and dispersal habitat, mountain lion is a highly mobile species, and abundant foraging and dispersal habitat is present in the region. The primary habitat impact would be the loss or disturbance of breeding habitat, including the potential to kill cubs if they are present in the area at the time of construction. The impacts on breeding habitat are nearly identical among alternatives because the majority of breeding habitat occurs in the Pacheco Pass Subsection, and all alternatives are identical in this subsection. The magnitude of permanent impacts on breeding habitat, in descending order, would be 710.2 acres under Alternative 3, 709.8 acres under Alternative 4, 709.4 acres under Alternative 2, and 709.3 acres under Alternative 1. The extent of temporary impacts, in descending order, would be 124.6 acres under Alternative 2, 123.9 acres under Alternative 1, 122.9 acres under Alternative 4, and 118.3 acres under Alternative 3. The magnitude of indirect impacts (introduction of invasive nonnative plants), while not quantified through the modeling effort, would be generally proportional to the quantity of direct impacts (Table 3.7-13).

As discussed in Impact BIO#1, construction of Tunnels 1 and 2 could have temporary indirect impacts on the hydrology of groundwater-dependent surface waters and associated vegetation types. Potentially affected surface waters could serve as water sources for mountain lions, potentially temporarily reducing the availability of water.

While pre-construction and construction actions (IAMFs) that avoid and minimize impacts on plants and wildlife, including the mountain lion, are part of the project, these actions will not prevent the conversion and temporary disturbance of habitat in the project footprint, nor will they necessarily eliminate the risk of disturbance, injury, or mortality of individual mountain lions. Construction-related ground disturbance (e.g., grading, excavation) and vehicle traffic may injure or kill mountain lions, including cubs, by crushing occupied dens or colliding with moving lions. Although unlikely, mountain lions may become entrapped in excavated areas, pipes, or other equipment used for construction. Noise and vibration generated by construction activities may impair mountain lions' feeding, breeding, and sheltering behaviors. Potential hazardous material

and pollutant releases and maintenance activities that involve pesticides or herbicides could degrade habitat or reduce prey species composition over the long term. Introduction of invasive nonnative vegetation could alter the structure of the vegetation community, making it less suitable to support mountain lions and could adversely affect the productivity of the prey base.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could result in a substantial adverse effect, through both direct mortality or disturbance of individuals and habitat modification, on mountain lion. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in a considerable loss and degradation of breeding and foraging and high-priority foraging and dispersal habitat; could result in injury or mortality of individuals in the construction footprint; and could cause noise- and vibration-related disturbance beyond the project footprint. These impacts could reduce the viability of local populations and contribute to the rangewide decline of this species. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#26b: Loss of Denning and Dispersal Habitat for and Direct Mortality or Disturbance of San Joaquin Kit Fox

Construction of the HSR track and systems in the eastern portion of the Morgan Hill and Gilroy Subsection and throughout the Pacheco Pass and San Joaquin Valley Subsections would take place in suitable habitat for San Joaquin kit fox, a species listed as endangered under FESA and threatened under CESA. Construction activities would convert and temporarily disturb habitat and could result in the disturbance, injury, and mortality of individual foxes.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#7, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1 and Impact BIO#6) into project design to avoid and minimize impacts on San Joaquin kit fox. The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat; disturbance, injury, and mortality of individuals) in habitat for San Joaquin kit fox is shown in Table 3.7-13. In the Pacheco Pass and San Joaquin Valley Subsections, because the alternatives would be identical, the impacts would also be identical. In the Morgan Hill and Gilroy Subsection, there would be a minimal difference between Alternative 3 and Alternatives 1, 2, and 4, associated with the alignment of Alternative 3 through east Gilroy. The magnitude of permanent impacts, in descending order, would be 2,914.4 acres under Alternative 3; 2,023.1 acres under Alternative 4; and 2,021.5 acres under Alternatives 1 and 2. The extent of temporary impacts, in descending order, would be 860.1 acres under Alternatives 1 and 2; 857.9 acres under Alternative 4; and 848.2 acres under Alternative 3. The magnitude of indirect impacts (introduction of invasive nonnative plants), while not quantified through the modeling effort, would be generally proportional to the quantity of direct impacts. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

While pre-construction and construction actions to protect San Joaquin kit foxes are part of the project, these actions would not prevent the conversion and temporary disturbance of habitat in the project footprint, nor would they necessarily eliminate the risk of disturbance, injury, or mortality of individual foxes. Construction-related ground disturbance (e.g., grading, excavation) and vehicle traffic may injure or kill foxes by crushing occupied dens or colliding with moving foxes. Foxes may become entrapped in excavated areas, pipes, or other equipment used for construction. Noise and vibration generated by construction activities may impair fox breeding, feeding, and sheltering behaviors. Potential hazardous material and pollutant releases and maintenance activities that involve pesticides or herbicides could degrade habitat or reduce prey species composition over the long term. Introduction of invasive nonnative vegetation could alter the structure of the vegetation community, making it less suitable to support kit foxes, and could adversely affect the productivity of the prey base.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could result in a substantial adverse effect, through both direct mortality or disturbance of individuals and habitat modification, on San Joaquin kit fox. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in loss and degradation of habitat, could result in injury or mortality of individuals, and could cause noise- and vibration-related disturbance beyond the project footprint. These impacts would reduce the viability of local subpopulations and contribute to the rangewide decline of this species. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#27: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Fresno Kangaroo Rat

Construction of the HSR track and systems in the San Joaquin Valley Subsection would take place in suitable habitat for Fresno kangaroo rat, a species listed as endangered under both FESA and CESA. Although there are no known occurrences in the regional RSA, if any individuals are present, construction activities would convert and temporarily disturb habitat and could result in the disturbance, injury, and mortality of individual kangaroo rats.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#6, BIO-IAMF#7, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1 and Impact BIO#6) into project design to avoid and minimize impacts on Fresno kangaroo rat. The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat; disturbance, injury, and mortality of individuals) in habitat for Fresno kangaroo rat is shown in Table 3.7-13. In the San Joaquin Valley Subsection, because the alternatives would be identical, the impacts would also be identical. The magnitude of permanent and temporary impacts would be 58.8 acres and 46.3 acres, respectively, under all four alternatives. The magnitude of indirect impacts (introduction of invasive nonnative plants), while not quantified through the modeling effort, would be generally proportional to the quantity of direct impacts. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

While pre-construction and construction actions to protect Fresno kangaroo rats are part of the project, these actions would not prevent the conversion and temporary disturbance of suitable habitat in the project footprint, nor would they necessarily eliminate the risk of disturbance, injury, or mortality of individual kangaroo rats. Construction-related ground disturbance (e.g., grading, excavation) and vehicle traffic may injure or kill kangaroo rats by crushing occupied burrows or running over moving individuals. Kangaroo rats may become entrapped in excavated areas. Noise and vibration generated by construction activities may impair breeding, feeding, and sheltering behaviors. Potential hazardous material and pollutant releases and maintenance activities that involve pesticides or herbicides could degrade habitat over the long term. Introduction of invasive nonnative plants could alter the structure of vegetation, making it less suitable to support kangaroo rats and other small mammals.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could result in a substantial adverse effect, through both direct mortality or disturbance of individuals and habitat modification, on Fresno kangaroo rat. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss habitat, the project would result in loss and degradation of habitat, could result in injury or mortality of individuals, and could cause noise- and vibration-related disturbance beyond the project footprint. The current distribution of this species is very restricted (i.e., it only occurs in a few areas of natural habitat surrounded by inhospitable land use) and the population size is low. Therefore, any reduction in available habitat or mortality of individuals would contribute to the further decline of this endangered species. Mitigation measures to address this impact are

identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#28: Loss of Denning and Dispersal Habitat for and Direct Mortality or Disturbance of American Badger

Construction of the HSR track and systems would take place in suitable habitat for American badger, a CDFW species of special concern. While habitat is present in all five subsections, the preponderance is in the Morgan Hill and Gilroy and Pacheco Pass Subsections because of the extensive and unfragmented grassland, chaparral, and scrub in these areas. Construction activities would convert and temporarily disturb habitat and could result in the disturbance, injury, and mortality of individual badgers.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#7, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1 and Impact BIO#6) into project design to avoid and minimize impacts on American badger. The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat; disturbance, injury, and mortality of individuals) in habitat for American badger is shown in Table 3.7-13. The magnitude of permanent impacts would be, in descending order, 805.4 acres and 399.3 acres, respectively under Alternative 2; 799.6 acres and 378.9 acres under Alternative 3; 798.6 acres and 374.5 acres under Alternative 1; and 778.4 acres and 350.7 acres under Alternative 4. Work on Tunnels 1 and 2 would result in the most extensive impacts. The magnitude of indirect impacts (introduction of invasive nonnative plants), while not quantified through the modeling effort, would be generally proportional to the quantity of direct impacts. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without habitat for American badger and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

While pre-construction and construction actions to protect American badgers are part of the project, these actions would not prevent the conversion and temporary disturbance of suitable habitat in the project footprint, nor would they necessarily eliminate the risk of disturbance, injury, or mortality of individual badgers. Construction-related ground disturbance (e.g., grading, excavation) and vehicle traffic may injure or kill badgers by crushing occupied burrows or by vehicle strike. Badgers could become entrapped in excavated areas as well as in pipe and other construction materials and equipment. Noise and vibration generated by construction activities may impair breeding, feeding, and sheltering behaviors. Potential hazardous material and pollutant releases and maintenance activities that involve pesticides or herbicides could degrade habitat or reduce prey species composition over the long term. Introduction of invasive nonnative vegetation could alter the structure of the vegetation community, making it less suitable to support badgers, and could adversely affect the productivity of the prey base.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could result in a substantial adverse effect, through both direct mortality or disturbance of individuals and habitat modification, on American badger. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in loss and degradation of habitat, could result in injury or mortality of individuals, and could cause noise- and vibration-related disturbance beyond the project footprint. American badgers are uncommon, have large home ranges, and produce few offspring (two to three young per litter). Therefore, any reduction in available habitat or displacement of badgers from the habitat study area would reduce the viability of the regional population and contribute to the statewide decline of the species. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#29: Permanent Conversion or Degradation of Habitat for and Direct Mortality of San Francisco Dusky-Footed Woodrat and Ringtail

Construction of the HSR track and systems in all subsections except the San Joaquin Valley Subsection would take place in suitable habitat for San Francisco dusky-footed woodrat, a CDFW species of special concern and ringtail, fully protected under the Cal. Fish and Game Code. Construction activities would convert and temporarily disturb habitat and could result in the disturbance, injury, and mortality of individual woodrats and ringtails.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#7, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1 and Impact BIO#6) into project design to avoid and minimize impacts on San Francisco dusky-footed woodrat and ringtail. The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat; disturbance, injury, and mortality of individuals) in habitat for these two riparian mammals is shown in Table 3.7-13. The extent of permanent impacts by alternative is generally similar for all alternatives and would be, in descending order, 402.6 acres under Alternative 3; 400.1 acres under Alternative 1; 399.6 acres under Alternative 2; and 395.9 acres under Alternative 4. The extent of temporary impacts, in descending order, would be 113.2 acres under Alternative 2; 110.7 acres under Alternative 3; 102.3 acres under Alternative 1; and 84.0 acres under Alternative 4. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without habitat for San Francisco dusky-footed woodrats and ringtails and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources. While pre-construction and construction actions to protect San Francisco dusky-footed woodrats and ringtails are part of the project, these actions would not prevent the conversion and temporary disturbance of suitable habitat in the project footprint, nor would they necessarily eliminate the risk of disturbance, injury, or mortality of individual animals. Construction-related ground disturbance (e.g., grading, vegetation removal) and vehicle traffic may injure or kill woodrats or ringtails by destroying woodrat stick houses or ringtail nests or by vehicle strike. Animals could become entrapped in excavated areas as well as in pipe and other construction materials and equipment. Noise and vibration generated by construction activities may impair breeding, feeding, and sheltering behaviors or cause adults to abandon their young in areas subject to such disturbance. Potential hazardous material and pollutant releases and maintenance activities that involve pesticides or herbicides could degrade habitat or reduce prey species composition over the long term. Introduction of invasive nonnative vegetation could alter the structure of the vegetation community, making it less suitable to support woodrats and ringtails, and could adversely affect the productivity of the food web upon which these species depend.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could result in a substantial adverse effect, through both direct mortality or disturbance of individuals and habitat modification, on San Francisco dusky-footed woodrat and ringtail. While actions would be implemented before and during construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in loss and degradation of habitat, could result in injury or mortality of individuals, and could cause noise- and vibration-related disturbance beyond the project footprint. Both species nest in specific microhabitats (i.e., woodlands with dense understory and abundant woody debris, hollow logs, and tree crevices) and are therefore patchily distributed within suitable habitat. San Francisco dusky-footed woodrat also has a limited distribution. Therefore, any reduction in available habitat or displacement of individuals from the habitat study area would reduce the viability of affected populations. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#30: Loss of Roost Sites for and Direct Mortality or Disturbance of Special-Status Bats

Construction of the HSR track and systems in all subsections would take place in suitable habitat for pallid bat, Townsend's big-eared bat, western mastiff bat, and western red bat, all of which are CDFW species of special concern. Construction activities would convert and temporarily disturb habitat and could result in the disturbance, modification, or loss of both night and maternity roost sites, as well as associated injury and mortality of roosting individuals. Ground-disturbing activities (including tunnel boring), vegetation removal, and structure demolition (e.g., removal or modification of culverts, bridges, and old buildings) in suitable habitat for these species could destroy occupied roost sites, resulting in injury or mortality of adults and young. Construction-generated noise and vibration near potential roost sites, including caves or mines in or near the project footprint for Tunnels 1 and 2, could disturb maternity roosts and cause bats to abandon their young.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, and BIO-IAMF#8 (described in Impact BIO#1) into project design to avoid and minimize impacts on special-status bats. The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat; disturbance, injury, and mortality of individuals and roost sites) in roosting and foraging habitat for special-status bats is shown in Table 3.7-13. The aggregate magnitude of permanent and temporary impacts on nonoverlapping total habitat (i.e., roosting and foraging) for special-status bats would be, in descending order, 3,599.7 acres and 2,116.9 acres, respectively, under Alternative 2; 3,446.2 acres and 1,650.5 acres under Alternative 3; 3,383.1 acres and 1,612.8 acres under Alternative 1; and 3,133.7 acres and 1,252.7 acres under Alternative 4. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without habitat for special-status bats and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

While pre-construction actions to protect special-status species are part of the project, these actions would not prevent the conversion and temporary disturbance of suitable habitat for special-status bats in the project footprint, nor would they necessarily eliminate the risk of disturbance, injury, or mortality of individual bats or the disruption of roost sites.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project could have a substantial adverse effect, through disturbance, modification, or loss of maternity roosts, on pallid bat, Townsend's big-eared bat, western mastiff bat, and western red bat. The loss of roosting habitat is considered one of the primary conservation issues facing bat populations, with loss of maternity roosts considered especially significant (H.T. Harvey & Associates 2004: page 21). While actions would be implemented before construction to reduce the potential for direct harm to individuals and to minimize the loss of habitat, the project would result in loss and degradation of habitat for these species, could result in injury or mortality of individuals (including maternity and hibernacula roosts), and could cause roost abandonment through noise- and vibration-related disturbance beyond the project footprint. These impacts could reduce the viability of local populations and contribute to the statewide decline of these species. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Operations Impacts

Project operations would involve scheduled train travel between San Jose and Merced, as well as inspection and maintenance along the track and railroad right-of-way; at stations; at traction power sites, communications, and maintenance facilities; and along fencing and power transmission lines. General impact mechanisms associated with these activities include ground disturbance, vegetation removal, hazardous material and pollutant release, noise, vibration, visual disturbance, artificial light, and vehicle strike. Since there are no biological resources in or adjacent to the DDV, there would be no change in operational effects on biological resources.

Additional information on specific impact mechanisms is provided in the discussion of Impact Types and Mechanisms in Section 3.7.5.3.

Impact BIO#31: Intermittent Disturbance or Degradation of Habitat for Special-Status Plants during Operations

Project operations would include inspection and maintenance activities along the HSR right-of-way. Prior to initiating operations and maintenance (O&M) activities, the Authority will require that all workers attend WEAP training about sensitive biological resources (BIO-IAMF#4). This training would be provided to all employees prior to their involvement in any O&M activity and repeated on an annual basis. Training materials would identify and describe land cover types that may support special-status plants (e.g., vernal pools, freshwater emergent wetland) and their approximate locations within or adjacent to the right-of-way.

Right-of-way maintenance activities would include minor grading, clearing, and excavation needed to maintain adequate drainage or repair infrastructure; vegetation management, including application of herbicide to invasive weeds growing within the right-of-way; and vehicle traffic along maintenance roads. These activities may cause reduced survival of special-status plants inside the right-of-way that were avoided during construction, as well as any occurring outside of but within 100 feet of the right-of-way (i.e., special-status plant study area). Minor ground disturbance within the right-of-way may result in minor direct (filling, sedimentation, inadvertent release of oils and chemicals from parked vehicles or equipment) or indirect (hydrological interruption, introduction of invasive species) effects on special-status plant habitat in and adjacent to the right-of-way. If applied during high winds, herbicides could drift onto and cause mortality of special-status plants. Dust generated from maintenance vehicles could settle on the leaves of special-status plants, increasing the rate of water loss (i.e., transpiration). Such direct and indirect effects would degrade special-status plant habitat within the special-status plant study area and could lead to the eventual extirpation of special-status plant occurrences.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because HSR operations could have a substantial adverse effect, both directly and through habitat modifications, on special-status plant species. While actions would be implemented before operations to reduce the potential for impacts on special-status plants and their habitat, project operations would entail disturbance and potential degradation of special-status plant habitat through inspection and maintenance activities, potentially contributing to reduced survival of special-status plants. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#32: Intermittent Disturbance or Degradation of Habitat for Special-Status Wildlife during Operations

HSR operations would include inspection and maintenance activities along the HSR right-of-way. The Authority has incorporated BIO-IAMF#4 into project specifications to address disturbance or degradation of habitat for special-status wildlife associated with such activities.

Right-of-way maintenance activities would include minor grading, clearing, and excavation needed to maintain adequate drainage or repair infrastructure; vegetation management, including application of herbicide to invasive weeds growing within the right-of-way; and vehicle traffic along maintenance roads. Because much of the right-of-way would already have been subjected to extensive ground disturbance and construction activities and converted to HSR track and systems, the areas within the right-of-way would provide limited habitat for most special-status wildlife. Nevertheless, these activities may further degrade habitat areas inside the right-of-way that were avoided during construction, as well as habitat outside of but within 250 feet of the right-of-way (i.e., core habitat study area). Minor ground disturbance within the right-of-way may result in minor direct (filling, sedimentation, inadvertent release of oils and chemicals from parked vehicles or equipment) or indirect (hydrological interruption, introduction of invasive species) impacts on special-status wildlife habitat (including host and nectar plants for invertebrates such as the monarch butterfly) in and adjacent to the right-of-way. If applied during high winds,

herbicides could drift into and contaminate aquatic habitat features (e.g., ponds and wetlands) or affect other upland plants that may be host plants or nectar sources for invertebrates. Such direct and indirect impacts would degrade special-status wildlife habitat in the habitat study area. Some habitat areas may be degraded to the extent that they no longer support the resources necessary for species survival and reproduction, and therefore cease to function as habitat for those species. Wind caused by train operations could occur, potentially affecting special-status insects flights, foraging, or dispersal. However, effects of induced wind during operations will be a matter of the wind speed generated. The Authority studied induced wind speed from train operations, and potential effects on pollination, in whitepapers in 2012 (Authority 2012b, 2012c), and found that wind speed is not likely to be excessive at the edge of the right-of-way, predicted to be less than 5 miles per hour (mph) at a distance of 30 feet from a train going 220 mph. Consequently, wind speeds within proximity to trains are unlikely to substantially exceed normal wind speeds and are unlikely to affect flights, foraging, or dispersal.

Some special-status wildlife species, including pollinators such as monarch butterfly, may be able to access the right-of-way during operations, where they would be subject to train strike. Individual birds could be injured or killed through collision with HSR infrastructure such as traction power transmission facilities. Moreover, disturbance impacts (e.g., noise, visual stimuli) can alter movement patterns and degrade conditions that support special-status wildlife species. Because operations would potentially affect a wide array of wildlife taxa and because such impacts are primarily associated with wildlife moving across or near the project footprint, these impacts are collectively addressed in Section 3.7.7.7, Wildlife Movement.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because inspection and maintenance activities could have a substantial adverse effect, through habitat modification, on special-status wildlife species. While actions would be implemented before operations to reduce the potential for impacts on special-status wildlife and their habitat, inspection and maintenance activities would entail disturbance and potential degradation of special-status wildlife habitat, potentially resulting in some areas becoming inhospitable for special-status wildlife. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

3.7.7.3 Non-Special-Status Wildlife

No Project Impacts

The conditions describing the No Project Alternative are the same as those described in Section 3.7.6.2. The same planned development and transportation projects would generally result in increases in VMT, construction of new impervious surfaces, and conversion of land cover types to transportation uses, all of which would affect non-special-status wildlife.

Under the No Project Alternative, recent development trends are anticipated to continue, leading to impacts on biological and aquatic resources and wetlands. Future changes in land use or allowable density of development, as well as ground disturbance associated with future infrastructure improvements such as highway expansions to accommodate population growth, would have impacts on non-special-status wildlife similar to those that have resulted from past development, such as loss, degradation, and fragmentation of habitat and mortality of individuals and local populations.

Project Impacts

Construction Impacts

Impact BIO#33: Mortality of Non-Special-Status Terrestrial Wildlife

Construction of the HSR track and systems in all subsections would take place in habitat suitable to support non-special-status terrestrial wildlife species. Construction activities could result in mortality of individuals of such species. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without wetlands, waters, or habitat for common or rare, threatened, or endangered species, and thus construction would not change

effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#6, and BIO-IAMF#7 (described in Impact BIO#1 and Impact BIO#6) into project design to avoid and minimize impacts on non-special-status terrestrial wildlife. Biologists did not model habitat for non-special-status wildlife species because such habitat is ubiquitous throughout the RSA. Because of its greater reliance on embankment profiles, Alternative 2 would likely have a greater impact on non-special-status terrestrial wildlife than Alternatives 1, 3, and 4, which make greater use of aerial structures or existing at-grade Caltrain tracks that have a smaller footprint.

While pre-construction and construction actions to protect wildlife species are part of the project, these actions would not prevent the conversion and temporary disturbance of habitat suitable to support myriad non-special-status species in the project footprint, nor would they necessarily eliminate the risk of disturbance, injury, or mortality of individual animals. Construction-related ground disturbance (e.g., grading, excavation) and vehicle traffic may injure or kill wild animals by through vehicle strike or crushing of animals in subterranean burrows. Animals may become entrapped in excavated areas, pipes, or other equipment used for construction. Vegetation removal and structure modification or demolition activities could cause mortality of non-special-status birds and bats. Noise and vibration generated by construction activities may impair breeding, feeding, and sheltering behaviors.

CEQA Conclusion

The impact under CEQA would be less than significant for all four alternatives because, although construction activities could cause some mortality of non-special-status wildlife, mortality of non-special-status species is not a threshold of significance under CEQA; however, mandatory findings of significance pursuant to the CEQA Guidelines specify “substantially degrade the quality of the environment, reduce habitat of wildlife species, cause wildlife populations to drop below self-sustaining levels, threaten to eliminate a plant or animal community” as criteria for a finding of significance. In view of the relatively limited amount of disturbance and habitat loss in the context of the extensive range of common terrestrial species, there is no evidence that any of these criteria would be met, particularly in consideration of project actions that would avoid and minimize the potential impacts on non-special-status wildlife. Therefore, CEQA does not require mitigation.

Impact BIO#34: Removal or Degradation of Habitat for and Disturbance of Waterfowl and Shorebirds

Wetland and open-water habitat for waterfowl and shorebirds would be lost or disturbed as a result of HSR track and systems construction in all subsections. Disturbance of waterfowl and shorebirds would result from the noise, vibration, and visual disturbance associated with construction activities. The potential for impact would be greatest in the GEA and UPR IBAs. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without habitat for waterfowl and other shorebirds and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#8, BIO-IAMF#9, and BIO-IAMF#10 (described in Impact BIO#1) into project design to avoid and minimize impacts on waterfowl and shorebirds. While no specific model was developed for waterfowl and shorebirds, their potential habitat (e.g., agriculture, grassland, wetland) was estimated within the IBA boundaries (except urban) to have potential to function as roosting or forage habitat. This is especially true in wet years when the wetted footprint within the IBA boundary is extensive.

The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat, disturbance of individuals) on habitat for waterfowl and shorebirds is shown in Table 3.7-16. Impacts in the GEA would be the same under all four alternatives because they would

follow the same alignment in that area. Impacts in the UPR IBA would be slightly greater under Alternative 3 than under Alternatives 1, 2, and 4 because its alignment traverses more of the UPR IBA than the other alternatives. The magnitude of permanent impacts, in descending order, would be 369.3 acres under Alternative 3; 365.7 acres under Alternatives 1 and 2; and 323.4 acres under Alternative 4. The extent of temporary impacts would be, in descending order, 107.9 acres under Alternatives 1 and 2, 84.8 acres under Alternative 4, and 76.1 acres under Alternative 3. The magnitude of indirect impacts (introduction of invasive nonnative plant species), while not quantified through mapping efforts, would be generally proportional to the quantity of direct impacts.

While pre-construction and construction actions to protect waterfowl and shorebirds and their habitat are part of the project, these actions would not prevent the conversion and temporary disturbance of such habitat in the project footprint, nor would they eliminate the risk of disturbance of these species. Construction activities would convert suitable foraging and breeding habitat to HSR track and systems and would entail infrastructure modifications and utility relocations, and could lead to the introduction and spread of invasive nonnative species. Disturbance associated with human activities and noise could drive birds from productive foraging and resting areas, resulting in an impaired energy budget and potentially in reduced reproductive success. Increased cover of invasive weeds (e.g., perennial pepperweed) in wetlands could reduce emergent wetland vegetation that provides cover for waterfowl and overgrow bare areas (e.g., seasonal wetland depressions that hold water in winter and become muddy in spring) that provide foraging habitat for shorebirds.

Table 3.7-16 Impacts on Habitat for Waterfowl and Shorebirds in Important Bird Areas by Project Alternative (acres)

Land Cover Type	Alt 1		Alt 2		Alt 3		Alt 4	
	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp
Grasslands Ecological Area								
Agriculture[1]	38.8	20.0	38.8	20.0	38.8	20.0	38.8	20.0
Alkali marsh[2]	6.1	3.5	6.1	3.5	6.1	3.5	6.1	3.5
California annual grassland[3]	2.6	2.3	2.6	2.3	2.6	2.3	2.6	2.3
Constructed watercourse[4]	2.0	1.6	2.0	1.6	2.0	1.6	2.0	1.6
Freshwater marsh[2]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Freshwater pond	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Natural watercourse[4]	2.3	3.1	2.3	3.1	2.3	3.1	2.3	3.1
Subtotal	51.8	30.5	51.8	30.5	51.8	30.5	51.8	30.5
Upper Pajaro River/Soap Lake								
Agriculture	2.3	0.6	2.3	0.6	0.1	2.0	0.7	0.6
California annual grassland	10.5	5.3	10.5	5.3	18.8	10.0	7.7	5.2
Constructed basin[5]	12.7	1.3	12.7	1.3	0.0	0.0	0.0	0.0
Constructed watercourse	3.7	1.0	3.7	1.0	4.7	0.7	2.6	0.7
Freshwater marsh	2.2	0.0	2.2	0.0	11.0	0.2	2.2	0.0
Freshwater pond[5]	1.9	0.7	1.9	0.7	1.7	<0.1	1.9	0.7
Natural watercourse	0.3	1.3	0.3	1.3	0.5	0.0	0.4	0.7

Land Cover Type	Alt 1		Alt 2		Alt 3		Alt 4	
	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp
Row crops[1]	271.7	63.8	271.7	63.8	270.7	32.6	249.3	45.2
Seasonal wetland[6]	8.6	3.4	8.6	3.4	10.0	0.1	6.8	1.2
Subtotal	313.9	77.4	313.9	77.4	317.5	45.6	271.6	54.3
Total	**365.7**	**107.9**	**365.7**	**107.9**	**369.3**	**76.1**	**323.4**	**84.8**

[1] Includes irrigated or flooded rice fields that provide food resources for wintering shorebirds (Hickey et al. 2003) and waterfowl (CVJV 2006) and nesting habitat for breeding shorebirds (Strum et al. 2017) and waterfowl (CVJV 2006).
[2] Includes managed seasonal and semi-permanent wetlands that provide food resources for wintering shorebirds (Hickey et al. 2003) and waterfowl (CVJV 2006) and managed semi-permanent wetlands that provide nesting habitat for breeding shorebirds (Strum et al. 2017) and waterfowl (CVJV 2006).
[3] May include "vernal pool rangelands" that provide foraging habitat for shorebirds (Hickey et al. 2003).
[4] Provides resting habitat for wintering and breeding waterfowl.
[5] Provides food resources (e.g., rooted aquatic plants for dabbling ducks) and resting habitat for wintering and breeding waterfowl.
[6] Provide foraging habitat for waterfowl and shorebirds.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project would result in modification of habitat for and disturbance of waterfowl and shorebirds. Such impacts could interfere substantially with the movement of resident and migratory waterfowl and shorebirds. While actions would be implemented before and during construction to minimize the loss of suitable habitat, the project would result in loss and degradation of suitable habitat for these species as well as noise- and vibration-related disturbance beyond the project footprint. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Operations Impacts

Some non-special-status wildlife species may be able to access the right-of-way during operations, where they would be subject to train strike. Individual birds could be injured or killed through collision with HSR infrastructure such as traction power transmission facilities. Moreover, disturbance impacts (e.g., noise, visual stimuli) can alter movement patterns and degrade conditions that support non-special-status wildlife species. Because operations would potentially affect a wide array of wildlife taxa and because such effects are primarily associated with wildlife moving across or near the project footprint, these effects are collectively addressed in Section 3.7.7.7.

3.7.7.4 Special-Status Plant Communities

No Project Impacts

The conditions describing the No Project Alternative are the same as those described in Section 3.7.6.2. The same planned development and transportation projects would generally result in increases in VMT, construction of new impervious surfaces, and conversion of land cover types to transportation uses, all of which would affect special-status plant communities.

Under the No Project Alternative, recent development trends are anticipated to continue, leading to impacts on biological and aquatic resources and wetlands. Future changes in land use or allowable density of development, as well as ground disturbance associated with future infrastructure improvements such as highway expansions to accommodate population growth, would have impacts on special-status plant communities similar to those that have resulted from past development, such as loss, degradation, and fragmentation of habitat and mortality of individuals and local populations.

Project Impacts

Construction of the project alternatives would result in temporary and permanent changes to special-status plant communities. All aspects of construction and operations have the potential to

cause impacts, either from direct removal associated with construction or from indirect impacts such as changes in hydrology or noxious weed infestations. Special-status plant communities that would be affected by the project alternatives are shown in Table 3.7-17.

Construction Impacts

Impact BIO#35: Permanent Conversion or Degradation of Special-Status Plant Communities

Construction of the HSR track and systems in all subsections would take place in habitat that supports special-status plant communities. Construction would result in the conversion and degradation of such communities.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1) into project design to avoid and minimize impacts on special-status plant communities. Tunnels will be designed and constructed to avoid or minimize groundwater inflows during or around tunnels during construction (HYD-IAMF#5).

The areal extent of direct permanent and temporary impacts (conversion and disturbance of habitat, habitat fragmentation, hydrologic changes, and introduction of hazardous materials) on special-status plant communities is shown in Table 3.7-17. All four alternatives would have identical impacts on vernal pools because that community is only present in areas where the alignments are also identical; impacts on other communities would be similar across alternatives. Overall, the total magnitude of impacts on special-status plant communities would be substantially similar for all alternatives. The extent of permanent impacts would be, in descending order, 880.5 acres under Alternative 3; 872.9 acres under Alternative 2; 867.8 acres under Alternative 1; and 839.1 acres under Alternative 4. The extent of temporary impacts, in descending order, would be 4226.1 acres under Alternative 2; 401.6 acres under Alternative 1; 400.8 acres under Alternative 3; and 370.8 acres under Alternative 4. The DDV (which applies only to Alternative 4) construction area is entirely disturbed, urbanized land, without wetlands, waters, or habitat for common or rare, threatened, or endangered species and thus construction would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

Table 3.7-17 Impacts on Special-Status Plant Communities (acres)

Impacts	Alt 1		Alt 2		Alt 3		Alt 4	
	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp
Alkali marsh	6.2	3.5	6.2	3.5	6.2	3.5	6.2	3.5
Alkali scrub wetland	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4
Alkali vernal pool[1]	27.1	0.0	27.1	0.0	27.1	0.0	27.1	0.0
California annual grassland[2]	772.8	365.6	778.0	388.4	773.8	370.2	749.4	342.5
California sycamore woodland	9.4	3.2	9.4	3.2	9.4	3.2	9.4	3.2
Freshwater marsh	2.3	0.0	2.3	0.1	11.1	0.2	2.3	0.0
Mixed chaparral	15.8	3.8	15.8	3.8	15.8	3.7	15.8	3.8
Mixed riparian	15.2	11.1	15.2	12.4	17.3	13.0	11.9	9.0
Palustrine forested wetland	7.4	8.8	7.2	8.7	6.8	4.8	7.4	5.5
Seasonal wetland	10.7	5.2	10.8	5.6	12.1	1.8	8.7	2.9

Impacts	Alt 1		Alt 2		Alt 3		Alt 4	
	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp
Vernal pools[3]	0.4	0.0	0.4	0.0	0.4	0.0	0.4	0.0
Total	**867.8**	**401.6**	**872.9**	**426.1**	**880.5**	**400.8**	**839.1**	**370.8**

[1] The alkali vernal pool type includes areas mapped as vernal pool complexes. Acreage provided is an estimate of the wetted vernal pool area within vernal pool complexes, consisting of 45% wetted area and 55% upland area.
[2] Annual grassland is included because it may contain inclusions of serpentine bunchgrass grasslands.
[3] Temporary impacts = 0 because all vernal pool impacts are considered permanent.

As discussed in Impact BIO#1, construction of Tunnels 1 and 2 could have temporary indirect impacts on the hydrology of groundwater-dependent surface water features, including land cover types that qualify as special-status plant communities (e.g., California sycamore woodland) or that could contain unmapped occurrences of a special-status plant community (i.e., freshwater marsh, palustrine forested wetland, and seasonal wetland; see Table 3.7-8). In addition, groundwater reduction could affect deep-rooted oak trees outside of riparian zones, such as valley oaks in areas with relatively shallow groundwater tables. Any reductions in groundwater supply to such features could result in the desiccation of vegetation and eventual degradation of the affected community.

While pre-construction and construction actions to protect special-status plant communities are part of the project, these actions would not prevent the permanent conversion or temporary disturbance of such communities in and near the project footprint. Work to construct Tunnels 1 and 2 would affect the greatest area of special-status plant communities because of existing stands of California sycamore woodland, valley oak woodland, and purple needlegrass grassland, all of which would be permanently lost. Construction activities would also result in the temporary disturbance of special-status communities at these and other locations and reduced habitat value for some period of time after construction is completed.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project would result in loss or degradation of sensitive communities identified by the CDFW. While actions would be implemented before and during construction to minimize such impacts, the project would result in loss and degradation of special-status plant communities. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Operations Impacts

Impact BIO#36: Intermittent Disturbance or Degradation of Special-Status Plant Communities during Operations

Project operations would include inspection and maintenance activities along the HSR right-of-way. The Authority has incorporated BIO-IAMF#4 into project specifications to address disturbance or degradation of special-status plant communities associated with such activities. Right-of-way maintenance activities would include minor grading, clearing, and excavation needed to maintain adequate drainage or repair infrastructure; vegetation management, including potential trimming of trees within special-status communities (e.g., riparian) growing adjacent to the right-of-way and application of herbicide to invasive weeds within the right-of-way; and vehicle traffic along maintenance roads. Permanently affected stands of special-status plant communities in the project footprint would have been eliminated during construction, and therefore would not be affected further. However, special-status plant communities inside the right-of-way that were avoided during construction and outside but within 100 feet of the right-of-way (i.e., special-status plant study area) could potentially be affected by these activities. Minor ground disturbance within the right-of-way may result in minor direct (filling, sedimentation, inadvertent release of oils and chemicals from parked vehicles or equipment) or indirect (hydrological interruption, introduction of invasive species) effects on special-status plant communities in and adjacent to the right-of-way. Occasional trimming of riparian tree branches overhanging the right-of-way is not expected to

substantially degrade special-status plant communities because the branches of such trees are typically fast growing. If applied during high winds, herbicides could drift onto and cause mortality of plants growing in special-status plant communities. Dust generated by maintenance vehicles could settle on the leaves of plants in nearby special-status communities, increasing the rate of water loss (i.e., transpiration). Such effects would degrade special-status plant communities within the special-status plant study area.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because operations could have a substantial adverse effect on sensitive communities identified by the CDFW. While actions would be implemented before operations to reduce the potential for impacts on special-status plant communities, project operations would entail disturbance and potential degradation of special-status plant communities through inspection and maintenance activities. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

3.7.7.5 Aquatic Resources

No Project Impacts

The conditions describing the No Project Alternative are the same as those described in Section 3.7.6.2. The same planned development and transportation projects would generally result in increases in VMT, construction of new impervious surfaces, and conversion of land cover types to transportation uses, all of which would affect aquatic resources.

Under the No Project Alternative, recent development trends are anticipated to continue, leading to impacts on biological and aquatic resources, including wetlands. Future changes in land use or allowable density of development, as well as ground disturbance associated with future infrastructure improvements such as highway expansions to accommodate population growth, would have impacts on aquatic resources similar to those that have resulted from past development, such as loss, degradation, and fragmentation of habitat and mortality of individuals and local populations.

Project Impacts

Construction of the project alternatives would result in temporary and permanent impacts on aquatic resources. The project alternatives would result in direct and indirect impacts on waters of the state regulated by the SWRCB, and federally protected wetlands and other waters of the U.S. as well as riparian areas not considered jurisdictional under Section 404 of the CWA but regulated under Cal. Fish and Game Code Section 1600 et seq. (e.g., natural watercourses).

Construction Impacts

Impact BIO#37: Permanent Conversion or Degradation of Aquatic Resources Considered Jurisdictional under Section 404 of the Federal Clean Water Act or Regulated by the State

Construction of the HSR track and systems in all subsections would take place in areas that support aquatic resources considered jurisdictional under Section 404 of the CWA, and regulated by the SWRCB, including wetlands. Construction would result in the conversion and degradation of such aquatic resources through direct removal, filling, and hydrological interruption.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#8, BIO-IAMF#9, and BIO-IAMF#10 (described in Impact BIO#1) into project design to avoid and minimize impacts on aquatic resources. Tunnels will be designed and constructed to avoid or minimize groundwater inflows into tunnels during construction that may affect surface water resources overlying the tunnel alignment (HYD-IAMF#5), including waters of the state and of the U.S.

The areal extent of direct permanent and temporary impacts (Section 3.7.5.3, Methods for Impact Analysis) on aquatic resources considered jurisdictional under Section 404 of the CWA and as waters of the state is shown in Table 3.7-18. All four alternatives would have identical impacts on vernal pools because that community is only present in areas where the alignments are also

identical; impacts on other communities would be similar across alternatives. Overall, the total magnitude of permanent impacts on jurisdictional aquatic resources by alternative would be, in descending order, 110.8 acres under Alternative 3; 108.0 acres under Alternative 2; 100.5 acres under Alternative 1; and 96.5 acres under Alternative 4. The extent of temporary impacts would be, in descending order, 89.4 acres under Alternative 2; 87.5 acres under Alternative 1; 80.7 acres under Alternative 3; and 78.3 acres under Alternative 4. The DDV construction area is entirely disturbed, urbanized land and does not support wetlands or other waters or habitat for common or rare, threatened, or endangered species. Consequently, construction of the DDV would not change effects compared to Alternative 4 without the DDV. TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

As discussed in Impact BIO#1, construction of Tunnels 1 and 2 could have temporary indirect impacts on the hydrology of groundwater-dependent surface waters, including aquatic resources considered waters of the U.S. or waters of the state. Any reductions in groundwater supply to such features could temporarily reduce their habitat value and function.

While pre-construction and construction actions to protect aquatic resources are part of the project, these actions would not prevent the permanent conversion or degradation of aquatic resources in the project footprint. Work to construct embankment sections in the San Joaquin Valley Subsection and work in the Morgan Hill and Gilroy Subsection (primarily in the Soap Lake floodplain) would affect the greatest area of aquatic resources because of the extent of managed and natural wetland resources in those areas. Construction activities would result in the temporary disturbance of aquatic resources during construction and reduced value for some period of time after construction is completed as aquatic resources are restored and recover.

CEQA Conclusion

The impact under CEQA would be significant for all alternatives because the project would have a substantial adverse effect on state- and federally protected wetlands, through direct removal, filling, hydrological interruption, and other indirect means. While actions would be implemented before and during construction to minimize such impacts, the project would result in the loss and degradation of aquatic resources. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Table 3.7-18 Impacts on Aquatic Resources Considered Waters of the U.S. or Waters of the State by Alternative (acres)

Impacts	Alt 1		Alt 2		Alt 3		Alt 4	
	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp
Wetlands								
Alkali marsh	6.2	3.5	6.2	3.5	6.2	3.5	6.2	3.5
Alkali scrub wetland	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4
Alkali vernal pool[1]	27.1	0.0	27.1	0.0	27.1	0.0	27.1	0.0
Freshwater marsh	2.3	<0.1	2.3	0.1	11.1	0.2	2.3	<0.1
Mixed riparian–natural watercourse[2]	3.6	1.3	3.6	1.2	3.6	1.3	3.6	1.2
Palustrine forested wetland	1.6	5.5	1.5	5.6	1.1	1.7	1.9	2.4
Palustrine forested wetland–natural watercourse[2]	5.8	3.4	5.7	3.2	5.7	3.0	5.5	3.2
Seasonal wetland	10.7	5.2	10.8	5.6	12.1	1.8	8.7	2.9
Vernal pools	0.4	0.0	0.4	0.0	0.4	0.0	0.4	0.0

Impacts	Alt 1		Alt 2		Alt 3		Alt 4	
	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp
Subtotal wetlands	**58.2**	**19.3**	**58.1**	**19.6**	**67.8**	**11.9**	**56.2**	**13.6**
Nonwetlands								
Constructed basin	2.1	38.9	7.2	38.9	2.1	38.9	2.1	38.6
Constructed watercourse	21.9	13.4	24.4	14.3	22.7	13.1	20.0	13.0
Freshwater pond	4.5	0.9	4.5	0.9	4.3	0.2	4.5	0.9
Natural watercourse[2]	13.8	15.1	13.8	15.8	13.9	16.6	13.8	12.2
Reservoir	<0.1	0.1	<0.1	0.1	<0.1	0.1	0.0	0.0
Subtotal nonwetlands	**42.3**	**68.3**	**49.9**	**69.9**	**43.0**	**68.8**	**40.4**	**64.7**
Total Section 404 aquatic resources	**100.5**	**87.5**	**108.0**	**89.4**	**110.8**	**80.7**	**96.5**	**78.3**

[1] The alkali vernal pool type includes areas mapped as vernal pool complexes. Acreage provided is an estimate of the wetted vernal pool area within vernal pool complexes, consisting of 45% wetted area and 55% upland area.
[2] Areas of riparian vegetation were classified as wetlands when they are located within natural watercourses (i.e., below the limits of the ordinary high water mark).

Impact BIO#38: Permanent Conversion or Degradation of Resources Regulated under California Fish and Game Code Section 1600 et seq.

Construction of the HSR track and systems in all subsections would take place in areas that support aquatic and other related resources regulated under Cal. Fish and Game Code Section 1600 et seq., including riparian habitats. Construction would result in the conversion and degradation of such aquatic and other related resources through direct removal and degradation. Construction within aquatic resources regulated under Cal. Fish and Game Code Section 1600 et seq. could affect numerous native and nonnative fish and wildlife species, which occur in these areas and use them for foraging, breeding, or migration. As a result of the conversion or degradation of these resources, all four alternatives would have a substantial adverse effect on fish and wildlife species.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#6, BIO-IAMF#7, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1 and Impact BIO#6) into project design to avoid and minimize impacts on fish and wildlife resources protected under Section 1600 et seq. Tunnels will be designed and constructed to avoid or minimize groundwater inflows into tunnels during construction that may affect fish and wildlife resources dependent on rivers, streams or lakes overlying the tunnel alignment (HYD-IAMF#5), which are regulated under California Fish and Game Code Section 1600 et seq.

The areal extent of direct permanent and temporary impacts (direct removal or degradation) on aquatic and other related habitat and fish and wildlife resources regulated under Cal. Fish and Game Code Section 1600 et seq. is shown in Table 3.7-19. Overall, the total magnitude of permanent and temporary impacts on aquatic and other related habitat regulated under Cal. Fish and Game Code Section 1600 et seq. by alternative would be, in descending order, 94.7 acres and 98.4 acres, respectively, under Alternative 2; 87.2 acres and 94.1 acres under Alternative 1; 76.7 acres and 90.0 acres under Alternative 3; and 69.1 acres and 82.4 acres under Alternative 4. Indirect impacts (modification of hydrology, introduction of invasive nonnative species) were not quantified for this analysis, but they would be roughly proportional to direct impacts. The DDV construction area is entirely disturbed, urbanized land and does not support wetlands or other waters or habitat for common or rare, threatened, or endangered species. Consequently, construction of the DDV would not change effects compared to Alternative 4 without the DDV.

TDV construction would not expand the area subject to ground-disturbing activities under the alternatives, and thus would not change construction effects on any biological resources.

Table 3.7-19 Impacts on Aquatic and Other Related Resources Regulated under California Fish and Game Code Section 1600 et seq. by Alternative (acres)

Aquatic and Related Resources	Alt 1		Alt 2		Alt 3		Alt 4	
	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp
Riparian								
California sycamore woodland	9.4	3.2	9.4	3.2	9.4	3.2	9.4	3.2
Mixed riparian	15.2	11.1	15.2	12.4	17.3	13.0	11.9	9.0
Palustrine forested wetland	7.4	8.8	7.2	8.7	6.8	4.8	7.4	5.5
Subtotal riparian	**32.0**	**23.1**	**31.8**	**24.3**	**33.5**	**21.0**	**28.7**	**17.7**
Streams/Lakes/Rivers								
Constructed basin	15.0	41.6	20.2	43.1	2.3	39.1	2.1	38.6
Constructed watercourse	21.9	13.4	24.4	14.3	22.7	13.1	20.0	13.0
Freshwater pond	4.5	0.9	4.5	0.9	4.3	0.2	4.5	0.9
Natural watercourse	13.8	15.1	13.8	15.8	13.9	16.6	13.8	12.2
Reservoir	<0.1	0.1	<0.1	0.1	<0.1	0.1	0.0	0.0
Subtotal streams/lakes/rivers	**55.2**	**71.0**	**62.9**	**74.1**	**43.2**	**69.0**	**40.4**	**64.7**
Total Section 1600 resources	**87.2**	**94.1**	**94.7**	**98.4**	**76.7**	**90.0**	**69.1**	**82.4**

As discussed in Impact BIO#1, construction of Tunnels 1 and 2 could have temporary indirect impacts on the hydrology of groundwater-dependent surface waters, including rivers, streams and lakes regulated under Cal. Fish and Game Code Section 1600 et seq. Any reductions in groundwater supply to such features could temporarily reduce their habitat value and function.

While pre-construction and construction actions to protect aquatic and other related resources are part of the project, these actions would not prevent the permanent conversion or degradation of aquatic or other related resources in the project footprint. Work to construct the Pacheco Pass and the San Joaquin Valley Subsections would affect the greatest area of riparian habitats (California sycamore woodland and mixed riparian, respectively) because of the extent of those habitats in those subsections. Construction activities would result in the temporary disturbance of aquatic and other related resources during construction and reduced value for some period after construction is completed as aquatic and other related resources are restored and recover.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project would have substantial adverse effects, through conversion or degradation of habitat, on fish and wildlife resources protected under Cal. Fish and Game Code § 1600 et seq. While actions would be implemented before and during construction to minimize such impacts, the project could still result in substantial adverse effects on fish and wildlife resources. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Operations Impacts

Impact BIO#39: Intermittent Disturbance or Degradation of Aquatic and Other Related Resources during Operations

Project operations would include inspection and maintenance activities along the HSR right-of-way. The Authority has incorporated BIO-IAMF#4 in project specifications to address disturbance or degradation of aquatic and other related resources associated with such activities. Right-of-way maintenance activities would include minor grading, clearing, and excavation needed to maintain adequate drainage or repair infrastructure; vegetation management, including potential trimming of riparian trees growing adjacent to the right-of-way and application of herbicide to invasive weeds within the right-of-way; and vehicle traffic along maintenance roads. Permanently affected aquatic and other related features in the project footprint would have been eliminated during construction, and therefore would not be affected further. Aquatic resources inside the project footprint that were avoided during construction (e.g., natural watercourses spanned by viaduct) and outside but adjacent to the project footprint would remain and could potentially be affected by these activities. In addition, construction would result in the creation of new aquatic resources (e.g., constructed basins and watercourses for drainage) in some portions of the project footprint, and these features could also be affected. Minor ground disturbance within the right-of-way may result in minor direct (filling, sedimentation, inadvertent release of oils and chemicals from parked vehicles or equipment) or indirect (hydrological interruption, introduction of invasive species) impacts on aquatic resources in and adjacent to the right-of-way. Occasional trimming of riparian tree branches overhanging the right-of-way is not expected to substantially degrade riparian aquatic resources because the branches of such trees are typically fast growing. If applied during high winds, herbicides could drift into aquatic resources in and beyond the right-of-way, degrading water quality and causing mortality of wetland vegetation. Dust generated by maintenance vehicles could settle on the leaves of wetland plants in and adjacent to the right-of-way, increasing the rate of water loss (i.e., transpiration). Such impacts would degrade aquatic resources remaining in the right-of-way after construction as well as those outside but within 250 feet (i.e., aquatic RSA) of the right-of-way.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because operations along the project extent could have a substantial adverse effect on protected wetlands and other aquatic and riparian resources through direct removal, filling, hydrological interruption, or other means. While actions would be implemented before operations to reduce the potential for impacts on aquatic and other related resources, project operations would entail disturbance and potential degradation of aquatic and other related resources through inspection and maintenance. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

3.7.7.6 Protected Trees

No Project Impacts

The conditions describing the No Project Alternative are the same as those described in Section 3.7.6.2. The same planned development and transportation projects would generally result in increases in VMT, construction of new impervious surfaces, and conversion of land cover types to transportation uses, all of which would affect protected trees.

Under the No Project Alternative, recent development trends are anticipated to continue, leading to impacts on biological and aquatic resources and wetlands. Future changes in land use or allowable density of development, as well as ground disturbance associated with future infrastructure improvements such as highway expansions to accommodate population growth, would have impacts on protected trees similar to those that have resulted from past development, such as loss, degradation, and fragmentation of habitat and mortality of individuals and local populations.

Project Impacts

Construction of the project alternatives would result in the removal of trees protected under local ordinances. Protected trees are those that are identified in local ordinances or in local planning documents that have policies toward protection. The land cover types that could support protected trees are shown in Table 3.7-20, along with the areal extent of impacts on those types by project alternative.

Table 3.7-20 Impacts on Land Cover Types Likely to Support Protected Trees by Alternative (acres)

Land Cover Type	Alt 1		Alt 2		Alt 3		Alt 4	
	Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp
California sycamore woodland	9.4	3.2	9.4	3.2	9.4	3.2	9.4	3.2
Coast oak woodland	348.6	61.9	349.1	62.5	349.2	65.1	348.6	62.0
Mixed chaparral	15.8	3.8	15.8	3.8	15.8	3.7	15.8	3.8
Ornamental woodland	4.3	13.1	1.8	20.2	4.6	20.6	0.1	0.7
Palustrine forested wetland	7.4	8.8	7.2	8.7	6.8	4.8	7.4	5.5
Urban landscaping	12.5	21.1	11.4	17.3	12.3	21.4	2.5	1.1
Total	**398.0**	**111.9**	**394.7**	**115.7**	**398.1**	**118.8**	**383.8**	**76.3**

Construction Impacts

Impact BIO#40: Removal or Mortality of Trees Protected under Municipal Tree Policies or Ordinances

Ground disturbance and vegetation removal activities associated with project construction could result in removal or trimming of protected trees. Direct impacts on protected trees would be permanent if such trees are removed during construction; impacts would be considered temporary if trees are partially removed (trimmed). The primary direct permanent impact would be the removal of protected trees for HSR track and systems. The primary direct temporary impact would be minor trimming or root disruption during construction. Potential indirect impacts include injury or mortality of protected trees due to reduced soil aeration and water availability from changes in topography and hydrology. All four project alternatives would affect a similar areal extent of land cover types potentially supporting protected trees. Impacts are likeliest to occur in the developed portions of the San Jose Diridon Station, Monterey Corridor, and Morgan Hill and Gilroy Subsections that are subject to municipal tree policies or ordinances.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, and BIO-IAMF#8 (described in Impact BIO#1) into project design to avoid and minimize impacts on protected trees. The areal extent of permanent and temporary direct impacts (removal and trimming of protected trees) on land cover types suitable to support protected trees would be nearly the same under all four alternatives. The magnitude of permanent impacts by alternative would be, in descending order, 398.1 acres under Alternative 3, 398.0 acres under Alternative 1, 394.7 acres under Alternative 2, and 383.8 acres under Alternative 4. The extent of temporary impacts would be 118.8 acres under Alternative 3, 115.7 acres under Alternative 2, 111.9 acres under Alternative 1, and 76.3 acres under Alternative 4. The magnitude of indirect impacts, while not quantified through the mapping effort, would be generally proportional to the quantity of direct impacts.

While pre-construction and construction actions to preserve protected trees are part of the project, these actions would not entirely preclude impacts on protected trees. Some trees would be removed and others would be trimmed to facilitate project construction. Reduced soil aeration and water availability for protected trees' root systems could occur both inside and outside the project footprint and could reduce the long-term viability of protected trees. Natural land cover

types that support protected trees adjacent to the project footprint could be invaded by nonnative plants that become established during construction or that spread from existing stands as a result of soil disturbance.

In addition to direct effects, there is also the potential for indirect effects on protected oak trees along the tunnel alignments due to potential groundwater reduction during tunnel construction. This would only occur where tree roots are particularly deep and groundwater is relatively shallow (such that tree roots can reach groundwater). As discussed in Section 3.8, despite implementation of HYD-IAMF#5, the project could still lower groundwater levels in discrete portions of the tunnel alignment (the effect is not expected along the entire length of the tunnel alignments due to limited groundwater resources along most of the tunnel alignment). Groundwater levels in these discrete areas could be lowered for up to several years after construction until they recover with infiltration of precipitation. Oak trees in these discrete areas could be affected if the groundwater-lowering extends below their roots and the trees were to become dependent on precipitation only until the aquifer recovers. This could result in impaired tree health or mortality.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because project construction would conflict with local policies or ordinances protecting designated trees. Construction would require the removal of some protected trees and the trimming of others. While actions would be implemented before and during construction to reduce loss of or damage to protected trees, the project would result in removal and trimming of a large number of protected trees due to the large areal extent of land cover types supporting them. In addition, potential groundwater reduction in discrete portions of the tunnel alignments may occur during tunnel construction, which may affect oak trees in areas of relatively shallow groundwater. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Operations Impacts

Impact BIO#41: Disturbance of Trees Protected under Municipal Tree Ordinances during Operations

Operations would not result in permanent impacts (i.e., removal) on protected trees under any of the alternatives, but ongoing vegetation management within the electrical safety zone could result in temporary impacts (i.e., occasional trimming). The Authority will require that all workers attend WEAP training about sensitive biological resources, including protected trees (BIO-IAMF#4). The project tunnels will be designed to be watertight and thus no operational effects due to groundwater flows are expected during operations.

CEQA Conclusion

The impact under CEQA would be less than significant for all four alternatives because project operations would not remove any protected trees. Any protected trees within the footprint of HSR tracks, facilities, or infrastructure would already have been removed during construction. Intermittent operations impacts on protected trees would occur when such trees are trimmed during vegetation management activities within the right-of-way. Nonprotected trees may grow into protected size classes during the operational period and need to be trimmed. These impacts would not conflict with local tree preservation policies or ordinances because they would not involve the permanent removal of protected trees. Therefore, CEQA does not require mitigation.

3.7.7.7 Wildlife Movement

In addition to addressing impacts on known or mapped wildlife corridors, this analysis more broadly addresses impacts on wildlife movement throughout the project extent. Similarly, although the primary focus of the analysis concerns wildlife movement, some of the nonphysical impact mechanisms that can interfere with movement (e.g., noise, visual disturbance, lighting) pertain equally to disturbance of resident individuals or populations (e.g., breeding, nesting, and foraging waterbirds). Because mapped corridors and other undeveloped areas are more hospitable to wildlife, such areas are likelier than more developed areas to support wildlife

movement as well as resident individuals and species. Accordingly, this analysis addresses these impacts for both resident and transient wildlife.

As noted throughout this Final EIR/EIS, mountain lion is currently considered a candidate for listing under CESA. Impacts on mountain lion were assessed in the WCA and considered in the Draft EIR/EIS and the Revised/Supplemental Draft EIR/EIS. Information on subpopulations within the ESU and additional information on specific mountain lion impacts related to movement are provided where appropriate below. Unlike the mountain lion, barriers to movement are not an identified threat to monarch butterflies in the listing petition (Center for Biological Diversity et al. 2014) nor is the project area near important and limiting overwintering habitat (which occurs on the coast) where disruptions to migratory or daily movement patterns could significantly affect the species. As a result, movement impacts on the monarch butterfly are not further evaluated.

No Project Impacts

The conditions describing the No Project Alternative are the same as those described in Section 3.7.6.2. The same planned development and transportation projects would generally result in increases in VMT, construction of new impervious surfaces, and conversion of land cover types to transportation uses, all of which would affect wildlife movement.

Under the No Project Alternative, recent development trends are anticipated to continue, leading to impacts on biological and aquatic resources and wetlands. Future changes in land use or allowable density of development, as well as ground disturbance associated with future infrastructure improvements such as highway expansions to accommodate population growth, would have impacts on wildlife movement similar to those that have resulted from past development, such as impediments to wildlife movement along established corridors.

Project Impacts

Construction and operations of the project would result in permanent and temporary impacts on wildlife movement and corridors. Impacts on wildlife corridors were analyzed in detail and are presented in the WCA (Appendix C of the Biological and Aquatic Resources Technical Report [Authority 2020a]). In summary, the following construction and operations impacts on wildlife corridors are identified and discussed in the WCA:

- Project components that have the potential to temporarily affect wildlife movement during construction:
  - Fences and other physical barriers
  - Noise and vibration
  - Visual disturbance from construction equipment or personnel
  - Nighttime lighting
  - Dewatering (aquatic species only)
- Project components that have the potential to permanently affect wildlife movement as a result of construction include at-grade or embankment portions of the rail (because they are fenced or substantially above the existing ground elevation) as well as rail facilities adjacent to the rail (that are also permanently fenced).
- Operations and infrequent facilities maintenance have the potential to result in permanent, intermittent disturbance of wildlife movement through the following mechanisms:
  - Noise disturbance
  - Visual disturbance
  - Train lights and nighttime lighting on permanent facilities
  - Train strike
  - Electric line strike and electrocution
  - Entrapment

Construction Impacts

Impact BIO#42: Temporary Disruption of Wildlife and Wildlife Movement

Construction of the HSR track and systems in all subsections would temporarily affect wildlife movement of a variety of species, including mountain lion, a candidate for listing under CESA, in several ways. Construction fencing and dewatering would create temporary barriers to movement, precluding the normal movement of animals. Noise, vibration and visual disturbance from construction vehicles and pile driving may alter or delay movement of individuals as they attempt to avoid the construction area. Nighttime construction or security lighting producing ALAN could cause animals to delay or alter movement patterns because they may avoid lit areas.

ALAN during construction could potentially occur throughout the hours of darkness but would only occur in Coyote Valley and at tunnel portals, locations with low levels of existing ALAN. Construction within the GEA would not occur at night. Lighting during construction would be relatively low intensity and would be designed to meet Occupational Safety and Health Administration (OSHA) standards for general construction, 5 foot-candles (54 lux; 29 C.F.R. § 1926.56), at the limits of the construction area. Light would be directed on site but would be visible to wildlife outside the project footprint. Construction vehicle lighting (i.e., vehicles going to and coming from the project site or vehicles operating within the project footprint) may briefly direct headlights toward areas outside the project footprint. Though of short duration and limited spatial scope, lights of this intensity could influence wildlife behavior or physiology (see Section 1.3.2 in Appendix 3.7-F for additional information and discussion of intermittent lighting effects).

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, and BIO-IAMF#8 (described in Impact BIO#1) into project design to avoid and minimize impacts on wildlife movement. In addition, during construction, the contractor will minimize noise disturbance of wildlife by implementing such measures as construction of noise barriers, careful routing of truck traffic, construction of walled enclosures, scheduling noisy operations into the same period, and phased construction (NV-IAMF#1). Although the extent and location of construction activities would be broadly similar among the project alternatives, the severity of impacts of the alternatives would be, in descending order, Alternative 3, Alternative 1, Alternative 2, and Alternative 4 for the following reasons:

- Alternatives 1, 2, and 4 would cross less land that is protected to conserve wildlife movement in the Soap Lake floodplain than Alternative 3.
- Alternatives 1, 2, and 4 would cross less of the Santa Cruz Mountains to Diablo Range modeled linkage (Penrod et al. 2013) than Alternative 3.
- Alternatives 1, 2, and 4 would follow a highly developed transportation corridor in downtown Gilroy rather than crossing the undeveloped agricultural areas east of Gilroy where Alternative 3 would be constructed. These agricultural areas support wildlife movement.
- Alternatives 1 and 3 would bypass downtown Morgan Hill, fragmenting agricultural lands and requiring construction and infrastructure closer to Coyote Creek, a known wildlife movement corridor.
- Alternative 4 would be make use of the existing Union Pacific Railroad (UPRR) right-of-way and would require less area for construction on undeveloped land.

While pre-construction and construction actions to minimize impacts on wildlife movement are part of the project, these actions would not entirely preclude impediments to wildlife movement through and across the project extent. Temporary construction fencing and dewatering activities would impede terrestrial and aquatic wildlife movement. Construction noise, vibration, visual disturbance, and ALAN could discourage individuals from following normal movement pathways.

With respect to mountain lion, recently considered a candidate for listing under CESA, project construction would occur generally at the boundary between the CC-C and CC-N subpopulations. As described in the affected environment in Section 3.7.6.2, Biological Conditions, gene flow between subpopulations has been identified as a major factor affecting the long-term persistence

of mountain lion populations. Although the extent of active gene flow between the subpopulations (i.e., number of breeding mountain lions moving between subpopulations) is not known, movement of mountain lions across SR 152 in the Pacheco Pass region, as well as within Coyote Valley, has been documented both by camera stations and as evidenced through mountain lions killed by vehicle collisions in the region, and thus at least some gene flow is likely occurring. Mountain lions are sensitive to human activity, and they would be likely to avoid active construction areas. Consequently, construction activities are likely to temporarily limit the movement of mountain lions during the construction period or cause them to alter their behavior, including taking longer routes to avoid active construction areas. Such avoidance behaviors can be expected to result in additional stressors, including changes in breeding activity, as well as overall disruption of gene flow between subpopulations.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because project construction would interfere substantially with established native wildlife corridors. While actions would be implemented before and during construction to reduce such interference, project construction would impede wildlife movement through and across the project footprint. With respect to mountain lion, impacts on movement during construction are expected to be significant, with potential temporary disruptions to genetic flow between subpopulations. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#43: Permanent Impacts on Wildlife Movement

Construction of the project would permanently affect regional and local wildlife movement patterns by creating new barriers to local and regional wildlife movement and fragmenting habitat. Terrestrial species are most vulnerable to permanent movement impacts. Birds and bats are able to move over patches of unsuitable habitat. As described in the WCA (Appendix C of the *Biological and Aquatic Resources Technical Report* [Authority 2020a]), wildlife movement impacts on a variety of species movement guilds (represented by focal species) were assessed and form the basis for the summary of impacts described here. In general, terrestrial species are more vulnerable to permanent movement impacts. The WCA included an assessment of impacts on movement of mountain lion, a species recently considered as a candidate for listing under CESA, as a focal species representing a “high openness/high mobility movement guild”. Consequently, potential impacts on mountain lion were considered along with all other focal species. Changes to the project design (primarily the placement of viaduct sections and dedicated wildlife crossings) would provide for wildlife movement across the alignment in Coyote Valley, the Soap Lake floodplain, most of Pacheco Pass, and the Central Valley; however, barriers to movement would remain on the west slope of Pacheco Pass where the rail alignment parallel to Pacheco Creek would be placed on a series of continuous cut-and-fill slopes. Barriers to movement and habitat fragmentation reduce resource availability and isolate breeding groups; both conditions can ultimately lead to reduced reproductive success and inbreeding depression. This can be particularly true for mountain lion, as isolation of populations due to habitat loss and fragmentation of habitat has been identified as a significant threat to genetic health (Center for Biological Diversity 2019). The project would occur generally at the boundary between the mountain lion CC-C and CC-N subpopulations, and gene flow between these subpopulations has been identified as a significant issue to the long-term persistence of mountain lion populations in the region. Birds and bats are able to move over patches of unsuitable habitat and are thus not likely to be vulnerable to movement impacts.

The relative permanent impacts of the project alternatives on wildlife movement would result from the following characteristics:

- Alternatives 1 and 3 would be on viaduct through the Monterey Corridor and Morgan Hill and Gilroy Subsections, posing a relatively small contribution to the cumulative barriers to movement already existing in the region because the elevated guideway on viaduct would leave the landscape below permeable for movement.

- Alternatives 1, 2, and 4 would cross through downtown Gilroy, focusing construction and other local development in the downtown region, where development (rather than agriculture) is already the primary land cover type. Therefore, the addition of new developed surfaces would constitute a negligible change to the existing condition.
- Alternatives 1, 2, and 4 would minimize impacts on protected lands in the Soap Lake floodplain, which would leave this area open for movement.
- Alternatives 1, 2, and 4 would minimize impacts on the Santa Cruz to Gabilan Range modeled wildlife corridor (Penrod et al. 2013) through the UPR (also known as Soap Lake floodplain).
- Alternative 3 would cross undeveloped agricultural lands and protected lands east of downtown Gilroy, resulting in more severe impacts on wildlife movement than Alternatives 1, 2, and 4 in the Morgan Hill and Gilroy Subsection because the addition of a transportation corridor would add a barrier to movement in a relatively permeable landscape.

Alternative 2 would have the greatest impact on terrestrial wildlife movement because the alignment profile would be at grade or on embankment and fenced continuously through Coyote Valley, an important wildlife linkage mapped by Penrod et al. (2013) in the Morgan Hill and Gilroy Subsection. (Alternative 4 would also be at grade through Coyote Valley; however, breaks in the fencing to allow traffic to cross the alignment would also maintain wildlife permeability of existing railroad grade crossings). Alternative 3 would result in more extensive in-water impacts on aquatic species movement than Alternatives 1, 2, and 4 because of more extensive impacts in Llagas Creek.

With respect to mountain lion movement impacts, the overall description of permanent impacts on wildlife movement described above are applicable. However, additional information was provided in the Revised/Supplemental Draft EIR/EIS and now included in this Final EIR/EIS regarding impacts on mountain lion movement considering its recent change in status and information regarding subpopulations. All alternatives would have identical impacts on mountain lion movement within the Pacheco Pass Subsection because all alternatives are identical there. Alternative 2 would have greater potential to affect mountain lion movement overall, primarily because of the long portions of at-grade and on-embankment (rather than viaduct) profile in the Monterey Corridor and Morgan Hill and Gilroy Subsections. Alternative 4 would have slightly less potential for impacts compared to Alternative 2 because it includes at-grade fence breaks where traffic, and wildlife including mountain lions, could cross the rail. Alternatives 1 and 3 would cross Coyote Valley and the Soap Lake area with similar profiles (primarily viaduct with some at-grade portions). However, to avoid downtown Gilroy, Alternative 3 would traverse more undeveloped lands (primarily agricultural lands) than Alternative 1. Additionally, more of the Alternative 3 alignment would traverse the regional wildlife linkage modeled by Penrod et al. (2013) as that alternative bisects more parcels that are protected (either through conservation easement or ownership) to conserve this linkage (in part). For these reasons, Alternative 1 would likely have a lesser impact on the mountain lion.

While all alternatives would include wildlife undercrossings in locations known to be important for wildlife movement in Coyote Valley, eastern Pacheco Pass, and the Central Valley (as included in Chapter 2, Alternatives, and shown and identified in Volume 3, Preliminary Engineering for Project Design Record, of the Draft EIR/EIS), these project design features will not entirely preclude interference with existing wildlife movement across the alignment. This is particularly true in the locations between wildlife undercrossings of fenced at-grade and embankment portions of the rail where permeability would be further reduced below existing constrained conditions.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project would interfere substantially with established and potential wildlife corridors. While actions would be implemented before construction to reduce such interference (i.e., the inclusion of dedicated wildlife crossings in the project design), the presence of HSR facilities would impede wildlife movement through and across the project footprint. With respect to mountain lion, the inclusion of dedicated crossings and viaducts in the project design are expected to facilitate the continued

gene flow between subpopulations; however, some uncertainty exists around this conclusion, because the movement of mountain lions and thresholds for movement are not well understood. Consequently, impacts causing disruptions to genetic flow between subpopulations are possible and are considered potentially significant. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Operations Impacts

Operations are those activities that would take place after the construction phase and during the operational phase of the HSR system. In addition to train operations, these impacts are all those resulting from activities involving stations, parking structures and lots, support facilities, and columns supporting elevated structures. Examples of impact mechanisms that may result from project operations include disturbances from the operating rail line, maintenance activities (including occasional cleaning, inspection, and removal of vegetation and litter from wildlife crossing structures), noise from passing trains, lighting, vibration, and electrocution. Operations impacts are permanent in that they would continue through the life of the rail line; however, the impacts would be intermittent, occurring only periodically.

Behavioral changes could result when the presence of the rail line causes animals to alter or cease their movements in response to rail operations. Behavioral changes can be triggered by noise, vibration, artificial light, or increased activity (e.g., increased human presence at stations or in parking lots, maintenance activities). Behavioral changes may also result when the presence of HSR facilities introduces a resource that can be used by birds and bats. Examples of specific operations impacts include disturbance from noise and vibration, habitat avoidance, habitat loss, and habitat fragmentation.

Impact BIO#44: Intermittent Noise Disturbance of Wildlife Using Corridors during Operations

All four project alternatives would result in noise from train operations. Because of the frequency and speed of trains, noise created by train operations has the potential to affect wildlife movement and use of habitat. Maintenance activities are expected to be dispersed over time and location and are not expected to be of an intensity or duration to result in substantial impacts on wildlife movement or habitat use.

Terrestrial Species

The response of terrestrial wildlife to noise depends on the timing, intensity, and frequency of the sound, as well as the species' tolerance to noise. In general, species' response to noise may result in behavioral changes (e.g., fleeing or hiding), interference with auditory cues (e.g., interference with mate attraction), or physiological responses (e.g., stress), each of which can result in broader impacts on movement, foraging efficiency, reproductive success, and survival (Francis and Barber 2013).

Impacts of operational noise are considered permanent and direct, though intermittent. As outlined in *San Jose to Merced Project Section: Noise and Vibration Technical Report* (Authority 2019c), noise generated by train operation falls into three distinct sound categories based on source location, strength, frequency content, directivity, and speed.

- Propulsion or machinery noise
- Mechanical noise resulting from wheel-rail interactions or guideway vibrations
- Aerodynamic noise resulting from airflow moving past the train, including the pantograph (FRA 2012).
- Noise levels from train operations are further based on source location, strength, frequency content, directivity, and speed. The following analysis considers noise impacts on mammals and on birds. Although reptiles and amphibians are also subject to noise impacts, they have substantially greater vulnerability to vibration impacts, which are discussed in Impact BIO#45.

Mammalian Species

Mammalian wildlife use sound mainly to forage, to evade predators, and for communication. Mammalian wildlife responses to noise depend on the timing, intensity, and frequency of the sound, as well as the species' tolerance to noise. The project alternatives would not create noise at magnitudes that could cause traumatic effects such as temporary or permanent loss of hearing. Exposure to noise may result in behavioral changes (e.g., fleeing or hiding), interference with auditory cues (e.g., interference with mate attraction), or physiological responses (e.g., stress or impaired bioenergetics), each of which can result in broader impacts on movement, foraging efficiency, reproductive success, and survival (Francis and Barber 2013). Among wildlife, hearing is very important for mammals. Hearing enables predators to be effective in situations where vision has limited usefulness, such as dense vegetation or darkness. Some animals such as mountain lions likely locate each other with auditory (as well as olfactory) signals (Center for Biological Diversity 2019). The primary impact of noise on mammalian wildlife, then, is the masking of acoustic information. Masking effects are only present for the duration of the noise exposure. If the noise is brief, normal behaviors return immediately upon cessation of the noise.

Masking also occurs in another form: the noise of the train is masked by other noisy features of the landscape. These mainly consist of urban areas and major highways, chiefly U.S. Highway 101, SR 152, and I-5. These features produce noise of a magnitude comparable to that of the HSR line, and they produce that noise more continuously. Thus, for instance, the noise of the train would be masked from wildlife located east of U.S. Highway 101 in Coyote Valley, whereas there is no comparable masking from any feature located west of the rail line in Coyote Valley. Due to masking by urban areas, noise impacts would mainly occur in the Soap Lake region, in the area from south of Gilroy to the west portal of the Pacheco Pass tunnel, and in the area from the east portal of that tunnel to the eastern limit of the project. In each of these areas, mammalian wildlife would be affected.

Mountain lions may occur in Coyote Valley and in the upper Pacheco Creek area west of the west portal of the Pacheco Pass tunnel. Mountain lions are sensitive to human noise sources, and train noise could deter them from crossing the rail alignment or from foraging in the vicinity of the alignment. These effects are moderated by the presence of an extended quiet period between the hours of midnight and 6 a.m., which is the period when mountain lions are most active, when the alignment would experience only infrequent maintenance traffic.

San Joaquin kit fox may occur in the area east of the east portal of the Pacheco Pass tunnel and are especially known to use grassland habitat in the vicinity of the California Aqueduct. San Joaquin kit fox may be sensitive to human noise sources, and noise could interfere with their hunting behavior, as well as with their normal movements across the rail alignment. These effects are moderated because the fox is most active between midnight and 6 a.m., when operations on the HSR alignment would be limited to intermittent, slower-speed maintenance vehicles.

Fresno kangaroo rats may occur in the San Joaquin Valley portion of the alignment. Fresno kangaroo rats may be sensitive to human noise sources, and noise could interfere with their foraging behavior, as well as with movements across the rail alignment. Normally a burrowing animal, the kangaroo rat is most active aboveground shortly after sunset, and trains are sufficiently frequent at that time to preclude or reduce kangaroo rat activities near the alignment, although kangaroo rat movement would be relatively unimpeded later in the night—for example, between midnight and 6 a.m.—when operations on the HSR alignment would be limited to intermittent, slower-speed maintenance vehicles.

Other mammalian wildlife potentially affected by noise include the special-status species tule elk, badger, dusky-footed woodrat, ringtail, Townsend’s big-eared bat, western mastiff bat, pallid bat, and western red bat, as well as a wide variety of non-special-status mammals. Of these special-status species, the tule elk, badger, dusky-footed woodrat, ringtail, and bats are nocturnal, with peak activities during times of low or no train activity. Bats are unlikely to be substantially affected by HSR train noise because they primarily hear at frequencies higher than those dominating the acoustic spectrum of HSR train noise, and the HSR train noise would be present only briefly and intermittently.

Bird Species

As discussed in the WCA, project-related noise added to ambient noise may affect bird species through several mechanisms: permanent hearing damage, temporary hearing damage, arousal, and masking (the mechanism of introduced noise interfering with birds' ability to hear sounds that are necessary for normal behavioral functions, such as courtship, territorial interaction, detection of predators, and movement associated with foraging and migration) (Authority 2020a: Appendix C). The WCA determined that for birds and bats, three aerial species focal groups—waterfowl, shorebirds, and wading birds (collectively waterbirds)—were vulnerable to noise and were present in populations and concentrations substantial enough to be adversely affected. In the regional RSA, these focal groups are known to congregate in two primary locations: the UPR and GEA IBAs (National Audubon Society 2017a, 2017b). Numerous sensitive species are known to nest, forage, and congregate in large numbers (e.g., sandhill crane in the GEA) at these locations.

The WCA established quantitative noise thresholds for each of the mechanisms:

- Permanent hearing damage: 140 A-weighted decibels (dBA)
- Temporary hearing damage: above 93 but less than 140 dBA
- Masking: 84 dBA
- Arousal: 77 dBA

To determine the areal extent of each noise impact, a GIS-based sound model was intersected with all land cover types (except urban or developed types) within the GEA and UPR IBAs.[7] Table 3.7-21 summarizes the acreage impacts for each noise mechanism.

Table 3.7-21 Extent of Noise Impacts by Mechanism

Noise Impact	Impacts on Waterbird Habitat (acres)[1]			
	UPR IBA, Alts 1 and 2	UPR IBA, Alt 3	UPR IBA, Alt 4	GEA IBA, All Alts
Permanent hearing damage (> 140 dBA)	0	0	0	0
Temporary hearing damage (93–140 dBA)	61	85	61	33
Masking (>84 dBA)[2]	197	293	197	188
Arousal (>77 dBA)[3]	817	1,190	829	984

[1] Waterbird habitat (flooded habitat for waterfowl, shorebirds and wading birds) impacts were conservatively estimated by intersecting the noise impact contours with all land cover types within the GEA IBA except urban. This method is based on the assumption that most of the land within the GEA is flooded by the Grassland Water District in the fall and remains flooded through winter.
[2] Approximate value interpolated between 81 and 93 dBA modeled values.
[3] Approximate value interpolated between 69 and 81 dBA modeled values.
dBA = A-weighted decibel
GEA = Grasslands Ecological Area
IBA = Important Bird Area
UPR = Upper Pajaro River

All alternatives would have the same alignment and footprint in the Grasslands IBA. Alternatives 1, 2, and 4 would have the same footprint and alignment in the UPR IBA (i.e., the Soap Lake 10-year floodplain). Because Alternative 3 has a slightly longer extent in the Soap Lake 10-year floodplain, it has potential for a greater impact on waterbirds. These impacts were modeled for a train speed of 220 mph, so increasing the speeds from 200 mph to 220 mph in the Soap Lake area, as facilitated by the TDV, would not increase estimated impacts.

[7] Unlike the GEA IBA, which is purposely flooded to artificially extend the footprint and duration of the managed wetland footprint, the UPR IBA relies on natural rain events for flooding. The UPR IBA boundary more closely resembles the flooding footprint of the 100-year floodplain; consequently, the UPR IBA very rarely floods to its full extent. Because flooding is typically confined to the Soap Lake 10-year floodplain boundary, this is the areal extent that is most vulnerable to noise effects and the noise analysis is accordingly confined to this boundary.

There is also the potential for noise to impact bird overflights; this could affect migratory birds in any part of the alignment in the Grasslands and UPR IBAs, which are within the Pacific Flyway, a major migratory route for many bird species. Noise effect thresholds would be as stated above, except that, since areas at high elevation above ground have very low background noise levels, the masking threshold drops to 34 dBA in the absence of ambient noise sources. Birds flying at distances of less than 50 feet above a train moving at a speed of 220 mph would potentially be at risk of temporary hearing damage; it is however unlikely that birds engaged in migratory flight would be present at such a low altitude, except near times of take-off and landing. Birds in flight are fully active and aware, thus arousal is not a potential impact. Birds in flight do commonly communicate through flight calls, thus masking effects from train passage could disturb such communications. Birds flying at distances of less than 14,500 feet from a train moving at 220 mph would be subject to masking. The effect would be minimized by two considerations; first, the threshold for masking effects is conservatively set at 34 dBA; any background noise the bird might hear, such as the sound of rushing wind, would effectively raise that threshold. Second, masking would only occur during the time that the bird was within 14,500 feet of the moving train. For a bird flying at 13,500 feet above the train, that duration is about 35 seconds, increasing to 100 seconds for a bird 500 feet above the train.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project would interfere substantially with established wildlife movement corridors and with special-status species' use of foraging habitat. Specifically, noise created by train operations would adversely affect foraging and predator evasion by mammalian wildlife, including mountain lions and Fresno kangaroo rats, and could deter them from crossing the rail alignment. Such deterrence could also reduce movement of mountain lions between the CC-C and CC-N subpopulations, which has been identified as a significant issue for the long-term persistence of mountain lion populations in the region. Noise would also cause direct intermittent impacts on large congregations of wintering waterbirds in the GEA IBA and on birds in the UPR IBA by interrupting normal movement patterns associated with foraging and causing birds to fly away from approaching trains or avoid habitat along the railway. The loss in food energy gain from these disturbances could have population-level impacts for birds because food availability for wintering birds is a key factor limiting their size (CVJV 2006). This conclusion would not change with the TDV, nor would the extent of expected impacts. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#45: Intermittent Vibration Disturbance of Wildlife Using Corridors during Operations

Ground vibration is an oscillatory motion of the soil. Operations-related vibration can affect wildlife movement by altering behavior, potentially interfering with access to food sources, exposing animals to predation, or disrupting normal movements. Separating the effects of noise and vibration, which almost always occur in concert, is difficult, and published studies often do not clearly draw this distinction.

The intensity of vibration perceived by wildlife differs depending on the source, distance from the source, the substrate through which the vibration travels, and the animal's ability to perceive vibration. In addition, the potential for vibration to disturb wildlife movement is greater in locations where the rail alignment passes close to or through large patches of undeveloped lands where wildlife is more likely to be present and where background noise and vibration from traffic are minimal. Such areas include Coyote Valley, the Soap Lake floodplain, portions of Pacheco Pass, and the GEA.

The main source of operations-related vibration would be train passage. This vibration would take place throughout the project extent whenever trains pass. For most areas along the project extent, vibration from train passage has low potential to affect wildlife movement for one or more of the following reasons:

- Background noise and vibration levels associated with existing human activity are already quite high.

- The duration of vibration is brief; a train would take approximately 2 seconds to pass any given point, or 3 seconds if vibration impacts are assumed to extend up to 150 feet in front of and behind the train. At a maximum of 176 trains per day that amounts to a total exposure of about 9 minutes per day, or 0.6 percent of the time.
- Train passages would occur primarily during the day, while most activity by vulnerable wildlife receptors (discussed below) is nocturnal.

Vibration effects are most likely to be perceived by species such as reptiles and amphibians, some of which—specifically snakes—are the most vibration-sensitive wildlife species known. However, because the affected species are reasonably common and the impacts would be brief and primarily diurnal (snakes are chiefly nocturnal predators), these vibration impacts are unlikely to cause substantial or long-lasting impacts.

Amphibians are also highly sensitive to vibration, using ground vibration for communication, especially in the process of mate selection; thus, vibration generated by project operations at the time of amphibian breeding has the potential to affect the success of amphibian breeding activities and thereby to affect their population status.

Burrowing rodents, notably kangaroo rats, are potentially sensitive to vibration influences on behavior and on the risk of vibration-caused burrow collapse. Studies involving intensive seismic exploration (Cypher et al. 2016), which generates extensive ground vibrations, did not find evidence of burrow collapse; however, minimization measures, including avoiding kangaroo rat burrows by a buffer distance of at least 10 meters (33 feet), may have avoided such effects. Exclusion fencing would limit impacts on kangaroo rats by excluding species' use of habitat within a distance of up to 13 meters (42 feet) from the tracks. While some larger mammals can detect seismic waves (vibrations) over long distances, using them to communicate, larger mammals (such as mountain lion and San Joaquin kit fox) occurring in the project area are not known to use vibration to communicate or otherwise facilitate their normal behavior. Considering the limited area affected by vibration and the highly mobile nature of these species, impacts from vibration are not likely to be substantial.

Because vibration is likely to have greater impacts when the alignment profile is at grade, Alternatives 2 and 4 are more likely to result in an impact on wildlife movement than Alternatives 1 and 3. Alternative 3 is likely to cause a greater impact on wildlife movement than Alternative 1 because a longer portion of Alternative 3 overlaps with the Santa Cruz Mountains to Diablo Range wildlife linkage as mapped by Penrod et al. (2013). More of Alternative 3 also overlaps with lands conserved to protect movement corridors.

CEQA Conclusion

The impact under CEQA would be less than significant for all four alternatives. While reptiles, amphibians, and burrowing rodents may perceive ground vibrations caused by passing trains, such vibrations have low potential to affect wildlife movement because they would be of short duration and would occur primarily during the day when most vibration-sensitive wildlife species are inactive. Therefore, CEQA does not require mitigation.

Impact BIO#46: Intermittent Visual Disturbance of Wildlife Using Corridors during Operations

Mammalian Species

Movement patterns of mammalian species may be altered by visual stimuli associated with passing trains or maintenance activities at rail facilities. Mammals such as mountain lions are known to avoid human-occupied locations (Center for Biological Diversity 2019), and therefore the presence of humans during maintenance activities could be expected to potentially change movement patterns, including avoidance of an area. Moving trains may also cause visual cues, which cause animals to temporarily or permanently avoid an area.

Bird Species

The presence of a moving train on the landscape has the potential to produce a variety of behavioral responses in birds, including heightened alertness (a stress response that can have adverse bioenergetics and other physiological consequences) and flight (a similar but stronger response that may also expose birds to predation). The WCA (Authority 2020a: Appendix C) determined that raptors and waterbirds were vulnerable to visual stimuli within the GEA IBA and Soap Lake 10-year floodplain. The literature identifies two distances at which response to visual stimuli occurs for waterfowl: flight initiation distance (average 269 feet) and minimum approach distance (average 404 feet) (Livezey et al. 2016). The flight initiation distance is assumed to have potential for the greatest impact and was applied as a threshold to determine acres of affected habitat. Alternatives 1, 2, and 4 would affect 173 acres of habitat (i.e., habitat within the 269-foot flight initiation distance) in the Soap Lake 10-year floodplain, and Alternative 3 would affect 244 acres.[8] All four alternatives would affect 524 acres in the GEA IBA.

For raptors, the flight initiation distance from motor vehicles is 262 feet on average (Livezey et al. 2016). If a raptor nest is within this distance of the rail alignment, there is potential for train operations to cause nest abandonment. Alternative 3 has greater potential for visual disturbance of nesting raptors because it would traverse a considerable distance of agricultural lands east of Gilroy, characterized by both nesting habitat and suitable foraging habitat (agriculture and grasslands), in contrast with Alternatives 1, 2, and 4, which would pass through urbanized downtown Gilroy.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project would interfere substantially with established wildlife movement corridors. Specifically, visual disturbance created by train operations would cause direct intermittent impacts on large congregations of wintering waterbirds (e.g., sandhill crane) in the GEA and UPR IBAs by interrupting normal movement patterns associated with foraging and causing birds to fly away from approaching trains or avoid habitat along the railway. The loss in food energy gain from these disturbances could have population-level impacts because food availability for wintering birds is a key factor limiting their size (CVJV 2006). Passing trains could also cause raptors nesting within 269 feet of the alignment to abandon their nests, reducing reproductive success of affected pairs and viability of local populations. Visual disturbance created by train operations or by maintenance activities, including human presence, could also cause direct intermittent impacts on mammals, including mountain lion. Activities associated with operations could cause animals to change behaviors or to avoid an area. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#47: Intermittent and Permanent Lighting Disturbance of Wildlife and Wildlife Using Corridors during Operations

Terrestrial Species

ALAN has the potential to affect wildlife movement for most terrestrial species, including the mountain lion, a recent candidate for listing under CESA, in large part because a preponderance of wildlife movement occurs at night (Beier 2006; FHWA 2011). Operational light sources include passing trains and associated rail infrastructure, such as the maintenance of way facility (MOWF) and stations. Nighttime lighting is not expected to affect wildlife movement in urban or developed settings (such as near San Jose and Gilroy) where train and facility lighting would not significantly increase baseline light levels, particularly where these locations do not overlap with known movement corridors. Conversely, nighttime lighting impacts are expected to be greatest in natural settings, where baseline light levels are low, and in locations where wildlife is known to move. In addition, light impacts from trains are expected to be greatest where the rail is at grade and where there are low existing levels of ALAN. However, the impacts on movement from train light

[8] The waterfowl and shorebird habitat is assumed to be all land cover types except urban within the GEA IBA and the Soap Lake 10-year floodplain because all areas have potential to be flooded and provide habitat during fall and winter.

are likely to be less than those from noise and vibration because noise and vibration travel farther from the centerline than light (which is directed in front of the train). Lighting impacts from trains are expected to be greatest where the rail is at grade. The Authority has incorporated BIO-IAMF#12 into project design to avoid and minimize impacts from operational lighting sources by several methods, including using appropriate shielding to reduce horizontal or skyward illumination and avoiding the use of high-intensity lights (e.g., sodium vapor, quartz, and halogen). Additionally, BIO-IAMF#12 specifies that no lighting be installed under viaduct and bridge structures in riparian habitat areas.

Continuous sources of operations lighting would have little potential to affect wildlife, including mountain lion, because lighting would be directed toward the site and is predominantly of a fairly low intensity (approximately 5 lux for security lighting and approximately 20 to 50 lux at stations and the MOWF). Intermittent sources of operations lighting would at times be directed toward wildlife habitat; however, operations lighting from train headlights would mostly be directed ahead and within the fenced area along the alignment. Exposures would be brief but could potentially last for periods of minutes in the case of operations lighting from maintenance activities and up to 10 seconds in the case of operational train lighting. Exposure to intermittent light has been found to potentially affect melatonin metabolism and to elicit avoidance responses. Although no literature addresses intermittent light effects on mountain lion, or any large mammals, there is a potential for adverse behavioral and physiological effects on terrestrial wildlife resulting from intermittent light exposure from operations sources.

Because the project alignment and profile are the same for the Pacheco Pass and San Joaquin Valley Subsections, differences between alternatives would be confined to the San Jose Diridon Station Approach, Monterey Corridor, and Morgan Hill and Gilroy Subsections. All of these subsections have high levels of existing ALAN, and therefore substantial impacts from lighting are not expected within these subsections. Consequently, all alternatives are similar with respect to impacts from operational lighting on terrestrial wildlife species and wildlife corridors.

Aerial Species

Operations activities have the potential to generate light. HSR facilities with security lighting and train headlights produce light that could result in altered movement or foraging patterns in aerial species, particularly in birds. As discussed in the WCA (Authority 2020a: Appendix C), few quantitative studies are available to determine the distance at which this impact may occur; however, published analyses confirm some potential for impact. For example, hunting owls may perch on OCS structures and become disoriented by the headlight of the approaching train, resulting in train strike (Santos et al. 2017). Also, Longcore and Rich (2004) note that birds may become “trapped” by a cone of light, unwilling to exit into darkness. This behavior may elevate train strike risk for birds lit by the headlight of an approaching train.

ALAN has also been observed to cause altered melatonin metabolism in a wide variety of species, including birds and bats; such changes can affect circadian rhythms, reproductive timing, and many other aspects of physiology and behavior (Gaston and Holt 2018). Although these effects would be minimized as described above for terrestrial species, substantial exposure may occur for both bats and birds if they forage on insects attracted to ALAN sources; this is a particularly common behavior in bats and in the aerialist songbirds, such as swallows and swifts. Although improved access to this food source (flying insects) would be beneficial to many birds and bats, it could confer a competitive benefit on those animals relative to other birds and bats that actively avoid ALAN sources. Overall, headlight effects are brief and facility lighting effects are localized; thus, these ALAN sources are not expected to result in a substantial impact on birds or bats, and moreover most bird species are diurnal and would not be exposed to ALAN.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project would interfere substantially with established native wildlife movement corridors used by terrestrial species. Intermittent light could cause an avoidance response in wildlife, and exposure to intermittent light sources has been found to potentially affect melatonin metabolism, both creating temporary habitat quality reductions. Mitigation measures to address this impact are identified in

Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#48: Mortality Resulting from Train Strike during Operations

Terrestrial Species

Although the entire track alignment would be fenced with an 8-foot chain-link fence, except under Alternative 4 where there are breaks in the fencing for road crossings, it is possible that terrestrial species could enter the alignment and be struck by a moving train. The terrestrial wildlife species most likely to enter the alignment are small species such as mice and ground squirrels. Digging species (e.g., ground squirrels) are of particular concern because once a hole is dug under the fence, other species (e.g., badger, San Joaquin kit fox) may take advantage of it and enter the right-of-way. Also, animals are known to jump (e.g., deer, elk), climb (e.g., mountain lion), or push fences (e.g., elk).

Because terrestrial species are not expected to gain access to elevated sections, it is only at-grade sections that present risk of train strike. Alternatives 2 and 4 would be at grade through most of the Monterey Corridor and Morgan Hill and Gilroy Subsections, but because Alternative 4 has fence breaks at road crossings in this region it presents a greater potential for train strike than Alternatives 1, 2, and 3. Following Alternative 4, Alternative 1 is likely to have the least effect of train strike because Alternative 2 has a long at-grade segment in the Morgan Hill and Gilroy Subsection and Alternative 3 includes a relatively long at-grade segment through the agricultural lands east of Gilroy, which result in an elevated risk of train strike.

Aerial Species

Train operations pose the risk of injury and mortality to aerial species by striking birds or bats flying in the path of passing trains. See Impact BIO#2a for a discussion of Bay checkerspot butterfly and potential impacts on movement; monarch movement is not expected to be affected by the rail per discussions in Impact BIO#2b. The WCA (Authority 2020a) determined that all aerial species, including bats, would be vulnerable to train strike. Raptors and carrion feeders are vulnerable because of their potential to forage on carrion on or near the tracks. Blackbirds and other perching birds are vulnerable because they may perch on train infrastructure and be struck when attempting to fly away from passing trains. Aerial foragers and raptors are vulnerable while foraging close to the ground. Waterfowl, shorebirds, and wading birds are vulnerable to strike where their primary habitat is close to the rail because of their long, low take-off trajectories. Bees (e.g., honeybees), as well as other native and nonnative pollinators, could be struck and killed by moving trains, although this effect is expected to be minimal and similar to normal background impacts from passenger cars and trucks on roads. Additionally, wind caused by train operations could occur, potentially affecting bee and other pollinator flights, foraging, or dispersal. The Authority studied induced wind speed from train operations and potential effects on pollination in white papers in 2012 (Authority 2012b, 2012c) and found that wind speed at the edge of the right-of-way is predicted to be less than 5 mph at a distance of 30 feet from a train going 220 mph. Consequently, wind speeds within proximity to trains are unlikely to substantially exceed normal wind speeds and are unlikely to affect flights, foraging, or dispersal of bees and other pollinators. Finally, bats may roost in train infrastructure such as viaducts or tunnel entrances, increasing the potential for train strike.

Nevertheless, quantifying the severity of the impact is difficult. For special-status species with low reproductive rates such as the California condor, Swainson's hawk, sandhill crane, and golden eagle, the loss of one individual would be a substantial impact. For more common species, the injury or mortality of a small portion of the local or regional population is not likely to be a substantial impact.

Within the GEA IBA specifically, waterfowl, shorebirds, and wading birds are known to congregate in relatively large numbers, and intermittent strike of these special-status species could affect the abundance and local or regional populations of these species over time. While condor numbers are very low in the region, and there is no evidence of nesting, train strike has potential to affect the distribution and abundance of local or regional populations of the species. USGS tracking data confirm condor flights over the proposed rail alignment in western Pacheco

Pass near Casa de Fruta; consequently, there is potential for individuals to be struck by the train while attempting to forage on carrion on or near the alignment.

The comparative risk for train strike between alternatives is primarily determined by rail profiles in the Morgan Hill and Gilroy Subsection. Portions of the alignment in urban areas of San Jose are not likely to pose a risk of train strike to special-status aerial species, and the Pacheco Pass and San Joaquin Valley Subsections are identical across alternatives. Alternative 3 poses a greater risk of train strike than Alternatives 1, 2, and 4 because it passes closer to Coyote Creek where riparian species—perching species and raptors in particular—are more likely to occur. Because bats are known to roost closer to water sources, they too may have greater potential to occur in this region. Also, Alternative 3 crosses a greater extent of the 10-year floodplain in the Soap Lake region.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project would potentially result in train strikes with wildlife species, which could interfere substantially with established native wildlife movement corridors. Project operations could cause direct mortality and injury of terrestrial and aerial wildlife trying to cross the alignment during operations. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#49: Injury and Mortality Resulting from Power Line Strike during Operations

Collisions with power lines, OCS, traction power station strain gantry, or other traction power facilities, or wireless communications facilities pose the risk of injury and mortality to aerial species. The WCA (Authority 2020a: Appendix C) concluded that all aerial species except bats would be vulnerable to collision with power lines. No studies have been found addressing the risk of electric line strike in bats, but it is presumed to be low because bats possess excellent echolocation abilities that should allow them to detect and evade wires.

Prior to construction, the Authority will design the OCS and other structures (e.g., fencing) to be bird- and raptor-safe in accordance with applicable Avian Power Line Interaction Committee (APLIC) recommendations (APLIC 2006, 2012) (BIO-IAMF#12). Design modifications would include installation of line marking devices on existing or new power lines in and near the project footprint. Such modifications would help to minimize collisions between birds that fly away from approaching trains and power lines. These modifications, in concert with the distance between OCS lines and grounds, would also minimize the risk of electrocution. As discussed for train strike, HSR infrastructure could influence behavior by introducing features and substrates that could attract aerial species to the guideway, thus putting them at risk of electric line strike. Most raptors possess keen vision and high flight maneuverability that likely helps to reduce risks of electric line strike, but they could still be vulnerable during times of limited visibility. Carrion-feeding birds, if foraging along the guideway, could be at increased risk of electric line strike. BIO-IAMF#12 will require that the OCS, fencing, and power lines be designed to be bird and raptor safe in accordance with APLIC guidance.

Because all four project alternatives would use the same electric line design attributes, potential differences in electric line strike risk, like those associated with train strike, are primarily determined by geography—the location of the proposed alignment—and, for certain focal groups, by track profile. For example, burrowing owls at San Jose International Airport may be at greater risk of electric line strike under Alternatives 1 and 4 than under Alternatives 2 and 3 because the former would use an embankment or at-grade profile near the burrowing owl population, while the others would use viaduct. Owls and other low-flying birds are more likely to fly beneath the viaduct and its OCS system than to attempt to fly through it, but they would fly over the embankment, risking electric line strike. Additionally, locations known to support large concentrations of waterfowl, shorebirds, and wading birds, such as the GEA IBA, would present a higher risk of injuries or fatalities from power line strike than other locations.

Because the alternatives are the same in the Pacheco Pass and the San Joaquin Valley subsections, the differences between alternatives are primarily isolated to the relatively undeveloped parts of the rail alignment where birds might congregate such as in or around

Coyote Creek or the UPR IBA. In the Coyote Creek area, Alternatives 2 and 4 would follow Coyote Creek for about 30 percent less distance than Alternatives 1 and 3. Because of the shorter distance of high-quality habitat that they would pass through, Alternatives 2 and 4 would likely pose less risk of electric line strike to raptors and perching birds that are more likely to use the riparian area than Alternatives 1 and 3.

The UPR IBA is important for all focal groups, and because of its abundant aquatic habitats it is particularly important to waterbirds. Alternatives 1, 2, and 4 would traverse 8.3 miles of the UPR IBA, while Alternative 3 would traverse 3.9 miles. However, because Alternative 3 would pass through more of the Soap Lake 10-year floodplain, the area of most intensive waterbird use, it may pose a risk of train strike comparable to that of Alternatives 1, 2, and 4.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because new power lines associated with project infrastructure could cause injury and mortality of birds in the GEA and UPR IBAs and carrion-feeding birds such as California condor. Project features will require that power lines be designed in accordance with bird-safe APLIC guidance. While useful for some aspects of the project (e.g., lines between traction power facilities and existing PG&E power lines), this guidance is primarily intended for power lines owned and operated by large-scale electrical utilities and does not address smaller design features of linear transportation infrastructure. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#50: Mortality Resulting from Entrapment in OCS Poles during Operations

European studies (Malo et al. 2016) have identified mortality associated with perching birds that fall into tubular steel OCS poles. This potential impact would be avoided by designing OCS poles to prevent this possibility, either by avoiding use of tubular metal poles or by capping the openings of such poles, as described in Chapter 7 of the WCA (Authority 2020a: Appendix C). This design feature will reduce the risk of aerial species mortality at OCS poles to a negligible level, and the difference between alternatives would be indistinguishable.

CEQA Conclusion

This impact would be less than significant under all alternatives because the minor design modification of capping tubular OCS poles would eliminate this risk. Therefore, CEQA does not require mitigation.

3.7.7.8 Conservation Areas

No Project Impacts

The conditions describing the No Project Alternative are the same as those described in Section 3.7.6.2. The same planned development and transportation projects would generally result in increases in VMT, construction of new impervious surfaces, and conversion of land cover types to transportation uses, all of which could affect conservation areas.

Under the No Project Alternative, recent development trends are anticipated to continue, leading to impacts on biological and aquatic resources and wetlands. Future changes in land use or allowable density of development, as well as ground disturbance associated with future infrastructure improvements such as highway expansions to accommodate population growth, would have impacts on conservation areas similar to those that have resulted from past development, such as habitat loss, fragmentation, and degradation, caused by the encroachment of new development into areas near or adjacent to conservation areas.

Project Impacts

Construction and operations of the project would result in permanent and temporary impacts on conservation areas, including public lands (refuges and ecological reserves), conservation easements, and mitigation banks. All aspects of construction and operations have the potential to cause impacts, either from direct removal of habitat or from indirect impacts such as the introduction of invasive species. The impact mechanisms for biological and aquatic resources

described in the above sections would occur in conservation areas that support these resources. In addition, permanent and temporary impacts in conservation areas would affect existing land management activities and infrastructure intended to conserve these resources on affected lands.

Construction Impacts

Impact BIO#51: Permanent Conversion or Degradation of Conservation Areas

Construction of the HSR track and systems in all subsections except the Monterey Corridor Subsection would have direct and indirect impacts on conservation areas. Construction activities would permanently convert or fragment and temporarily disturb conservation lands in the project footprint. Construction activities also have potential to alter management and affect existing infrastructure on conservation lands.

The Authority has incorporated BIO-IAMF#1, BIO-IAMF#3, BIO-IAMF#5, BIO-IAMF#8, BIO-IAMF#9, BIO-IAMF#10, and BIO-IAMF#11 (described in Impact BIO#1) into project design to avoid and minimize impacts on conservation areas. Tunnels will be designed and constructed to avoid or minimize groundwater inflows into tunnels during construction that may affect surface water resources overlying the tunnel alignment (HYD-IAMF#5), including those within conservation areas.

The areal extent of conversion and disturbance of conservation areas as a result of construction would be greatest under Alternative 3 and least under Alternative 1 (Table 3.7-22). The magnitude of permanent impacts by alternative would be, in descending order, 446.5 acres under Alternative 3; 413.3 acres under Alternative 2; 405.5 acres under Alternative 4; and 400.5 acres under Alternative 1. The extent of temporary impacts, in descending order, would be 151.5 acres under Alternative 2; 149.2 acres under Alternative 3; 135.3 acres under Alternative 1; and 133.5 acres under Alternative 4. The preponderance of direct impacts would be on the Halperin Conservation Easement, Soap Lake Ranch Easement, the Pacheco Creek Open Space Regional Reserve, and the Romero Ranch Conservation Easement in the Morgan Hill and Gilroy and Pacheco Pass Subsections, respectively. Impacts on the Pacheco Creek Open Space Regional Reserve and Romero Ranch Conservation Easement would be identical for all alternatives. Alternative 3 would affect substantially more of the Soap Lake Ranch Easement than the other three alternatives, which are identical. Only Alternative 3 would permanently affect the Bloomfield Conservation Area, although Alternatives 1 and 2 would have a minimal temporary impact. Additionally, Tulare Meadows was recently added as a conserved area by the SCVOSA and would be affected by Alternatives 2 and 4.

Table 3.7-22 Direct Impacts on Conservation Areas by Project Alternative (acres)

Conservation Area Name	Owner/Manager/Easement Holder	Alt 1		Alt 2		Alt 3		Alt 4	
		Perm	Temp	Perm	Temp	Perm	Temp	Perm	Temp
Fisher Creek Conservation Easement	Silicon Valley Land Conservancy	0.0	0.2	0.0	0.2	0.0	0.2	0.0	0.1
Mud Slough Conservation Easement	California Department of Fish and Wildlife	4.2	1.7	4.2	1.7	4.2	1.7	4.2	1.7
Romero Ranch Conservation Easement	The Nature Conservancy	352.1	112.7	352.1	112.7	352.1	112.7	352.1	112.7
Coyote Creek Parkway	City of Santa Clara Parks & Recreation	2.4	9.6	3.4	11.2	2.4	9.6	0.3	3.5
Guadalupe River Park and Gardens	City of San Jose	0.0	0.3	0.0	0.3	0.0	0.3	0.0	0.0
Halperin Conservation Easement[1]	Santa Clara Valley Open Space Authority	9.6	5.6	9.6	5.6	0.0	0.0	11.7	6.6
Pacheco Creek Open Space Regional Reserve	Santa Clara Valley Habitat Agency	23.6	4.8	23.6	4.8	23.6	4.8	23.6	4.8
Pajaro Ranch (Gonzales Farm)[1]	The Nature Conservancy	0.0	0.2	0.0	0.2	2.0	1.3	0.0	0.0
Pajaro River Agricultural Preserve	Santa Clara County Open Space Authority	1.7	0.0	1.7	0.0	1.7	0.0	1.7	0.0
Pajaro River Mitigation Bank	Wildlands, Inc.	0.0	0.0	0.0	0.0	6.2	3.7	0.0	0.0
Sequoia Riverlands Trust	Sequoia Riverlands Trust	0.6	0.0	0.6	0.0	0.6	0.0	0.6	0.0
Soap Lake Ranch Easement[1]	San Benito Agricultural Land Trust	6.9	0.0	6.9	0.0	45.7	9.9	6.9	0.0
Silveira	City of Santa Clara Parks & Recreation	0.0	0.0	2.7	5.0	0.0	0.0	0.0	0.0
Tulare Hill Land Bank	City of Santa Clara Parks & Recreation	0.0	0.0	1.8	0.2	0.0	0.0	0.0	0.0
Tulare Meadows[2]	Santa Clara Valley Open Space Authority	0.0	0.00	7.3	9.4	0.0	0.0	5.0	4.1
Tulare Hill Wedge Open Space Regional Reserve[3]	Santa Clara Valley Habitat Agency	0.0	0.0	2.8	0.4	0.0	0.0	0.0	0.0
Bloomfield (North and South) [1,4]	Santa Clara Valley Open Space Authority	0.0	0.2	0.0	0.2	8.6	5.0	0.0	0.0
Total Acres Affected		**401.01**	**135.3**	**416.7**	**151.9**	**446.4**	**148.9**	**406.1**	**133.5**
Number of Conservation Areas Affected		**12**		**16**		**12**		**10**	

Sources: GreenInfo Network 2016a, 2016b

[1] Several properties were collectively referred to as the "Soap Lake Properties" in the Draft EIR/EIS but have now been listed individually.

[2] Tulare Meadows was recently added as conserved lands by the Santa Clara Valley Open Space Authority.

[3] Tulare Hill Wedge Open Space Regional Reserve was recently added as conserved lands by the Santa Clara Valley Habitat Agency.
[4] Bloomfield was referred to as "Silacci" in the Draft EIR/EIS; however, the name has been corrected in this Final EIR/EIS.
Temp = temporary
Perm = permanent

As discussed in Impact BIO#1, construction of Tunnel 2 could have temporary indirect impacts on the hydrology of groundwater-dependent surface water features, including those within the Pacheco Creek Open Space Regional Reserve (Pacheco Creek and associated riparian vegetation), Cottonwood Creek Wildlife Area (ponds, streams, and wetlands), and Romero Ranch Conservation Easement (ponds, streams, and wetlands). Any reductions in groundwater supply to such features could temporarily reduce their habitat value and function.

While pre-construction and construction actions to protect conservation areas are part of the project, these actions would not prevent the conversion and temporary disturbance of such areas in the project footprint, nor would they completely eliminate the risk of long-term degradation of such lands outside the project footprint. Construction could result in the fragmentation or modification of a conservation area such that its purpose is no longer viable (e.g., an easement established to preserve a wildlife corridor may become ineffective if it is fragmented or bisected by HSR track and systems). Accidental discharge of hazardous substances (e.g., oil, gasoline) could degrade habitat that supports sensitive species. The introduction of invasive nonnative plants could alter the species composition of conservation lands, rendering them less able to support the sensitive communities.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the affected conservation areas contain land cover types that provide habitat for special-status species, support special-status plant communities (including riparian habitat) or aquatic resources, support wildlife movement corridors, or any combination of these. Consequently, impacts on conservation areas could have a substantial adverse effect on special-status species, riparian habitat, special-status plant communities, state and federally protected aquatic resources, and wildlife movement corridors. While actions would be implemented before and during construction to reduce the loss or degradation of conservation lands, the project would result in loss and degradation of such lands, as well as noise- and vibration-related disturbance and the possible spread of invasive nonnative plant species beyond the project footprint that could adversely affect sensitive resources. Mitigation measures to reduce this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Operations Impacts

Impact BIO#52: Introduction of Invasive Species or Contaminants into Conservation Areas during Operations

Project operations could have indirect impacts on conservation areas in all subsections. Direct impacts on conservation areas are not expected from operations. The primary operations activities affecting conservation areas would be routine inspections and maintenance of the HSR right-of-way. Where these activities would occur within the HSR right-of way, they have the potential to introduce contaminants from spills and to introduce invasive nonnative species to adjacent lands. These impacts could degrade habitat for special-status species, special-status plant communities, aquatic resources, and wildlife corridors, reducing the long-term viability of a conservation area. The Authority has incorporated BIO-IAMF#4 in project specifications to address introduction of invasive species or contaminants associated with such activities.

All project alternatives would be similar in their potential to cause these impacts. However, Alternative 3 would result in the most permanent impacts (Table 3.7-22) and, by extrapolation, the most indirect impacts during the operational period. Effects of project operations on special-status species, non-special-status species, special-status plant communities, aquatic resources, protected trees, and wildlife movement would also occur in conservation areas where such resources are present. These effects are described in the preceding impact discussions.

CEQA Conclusion

The impact under CEQA would be less than significant for all four alternatives because operations activities would be conducted in areas that have already been subjected to extensive ground disturbance and construction activities. Moreover, these activities would be intermittent and widely dispersed spatially. Therefore, CEQA does not require mitigation.

3.7.7.9 Habitat Conservation Plans

No Project Impacts

The conditions describing the No Project Alternative are the same as those described in Section 3.7.6.2. The same planned development and transportation projects would generally result in increases in VMT, construction of new impervious surfaces, and conversion of land cover types to transportation uses, all of which could affect the viability of existing HCPs.

Under the No Project Alternative, recent development trends are anticipated to continue, leading to impacts on biological and aquatic resources and wetlands. Future changes in land use or allowable density of development, as well as ground disturbance associated with future infrastructure improvements such as highway expansions to accommodate population growth, would have impacts on HCP areas similar to those that have resulted from past development, such as habitat loss, fragmentation, and degradation, caused by the encroachment of new development into areas near or adjacent to such areas.

Project Impacts

Construction of the project could conflict with three HCPs: the SCVHP, the Greenprint, and the *Coyote Valley Landscape Linkage* report. The SCVHP is an adopted HCP and NCCP prepared pursuant to Section 10 of the FESA and the NCCPA. Its provisions are expressed through an organizing hierarchy of biological goals, biological objectives, and two primary types of actions: acquisition actions, which address the acquisition of conservation areas; and management actions, which address the management of conservation areas. Each biological goal is implemented through the pursuit of one or more biological objectives, and some biological objectives require an acquisition or management action. Therefore, a conflict could occur if construction and operation of any project alternative would result in a failure to achieve any acquisition or management action specified under the SCVHP, and if such a failure would thereby preclude achieving a biological goal or objective of the SCVHP. Table I-1 in Appendix I of the Biological and Aquatic Resources Technical Report (Authority 2020a) summarizes potential conflicts with regard to each action in the SCVHP.

The Greenprint is an approved local plan for conserving habitats. Its provisions are expressed through an organizing hierarchy of goals and strategies. Each biological goal is implemented through the pursuit of one or more strategies. Therefore, a conflict could occur if construction or operation of any project alternative would result in a failure to implement any strategy specified under the Greenprint. Table I-2 in Appendix I of the Biological and Aquatic Resources Technical Report (Authority 2020a) summarizes potential conflicts with regard to each strategy in the Greenprint.

The *Coyote Valley Landscape Linkage* report is an approved local plan for identifying, protecting, and restoring areas essential for wildlife movement in Coyote Valley. Several land purchases consistent with the goals of the report have been made or are in process and wildlife crossing modifications are in the planning stage. Therefore, a conflict could occur if construction or operation of any project alternative would prevent any land purchases or impair wildlife crossing modifications associated with the report.

Construction Impacts

Impact BIO#53: Conflict with Santa Clara Valley Habitat Plan

As shown in Table I-1 in Appendix I of the Biological and Aquatic Resources Technical Report (Authority 2020a), the project has potential to conflict with three actions required by the SCVHP. There is also the potential that the project would conflict with other actions identified in the SCVHP. Some actions are planned for performance within the Pacheco Creek Open Space Regional Reserve but have not been identified as planned for performance on lands permanently or temporarily affected by the project. Other actions do not have an explicit geographic scope and might or might not be performed on lands affected, directly or indirectly, by the project. No conflicts with such actions have been identified. No other potential conflicts with the SCVHP are anticipated. The three potential conflicts would be the same under all four project alternatives:

with the SCVHP are anticipated. The three potential conflicts would be the same under all four project alternatives:

- Action LAND-L4 requires the acquisition and enhancement of natural and semi-natural landscapes between the Santa Teresa Hills and Metcalf Canyon to the south that will contribute to providing connectivity between the Santa Cruz Mountains and Diablo Range to promote the movement of covered and other native species at many spatial scales.
- Action LAND-WP7 requires the acquisition of habitat near Santa Teresa Hills and Tulare Hill to provide connectivity between populations in the Diablo Range and the Santa Cruz foothills.
- Action LAND-R3 requires the acquisition in fee title of or obtaining conservation easements on lands that protect at least 40 acres of existing California sycamore woodland (i.e., sycamore alluvial woodland) to preserve this rare land cover type in the SCVHP Plan Area. The biological objective that includes this action (Objective 9.2) further specifies that acquired stands should be at least 10 acres in size and contiguous.

The project would affect connectivity between the Diablo Range and the Santa Cruz foothills, creating a potential conflict with Actions LAND-L4 and LAND-WP7 of the SCVHP; however, the project alternatives would not affect the acquisition of lands targeted under Actions Land-L4 and Land-WP7. Impacts on connectivity between the Diablo Range and the Santa Cruz Mountains are discussed in more detail in the WCA (Authority 2020a: Appendix C).

There are two potential conflicts with Action LAND-R3 of the SCVHP: impacts on the Pacheco Creek Open Space Regional Reserve, a property owned and managed by the SCVHA; and a lack of available acres of California sycamore woodland to meet the combined preservation and restoration needs of the SCVHA and the Authority. The SCVHA acquired the 55.4-acre Pacheco Creek Open Space Regional Reserve in 2017 because the property would address goals and objectives of the SCVHP, including Action Land-R3 (under Objective 9.2 in the SCVHP) (SCVHA 2019), which commits to the acquisition of at least 40 acres of large (at least 10 acres), contiguous stands of California sycamore woodland (County of Santa Clara et al. 2012). The reserve includes an 8.2-acre contiguous stand of sycamore alluvial woodlands, of which the project would affect 2.7 acres (0.4 acre permanent, 2.3 acres temporary). An impact on an existing reserve owned and managed by the SCVHA for the purposes of meeting the requirements under the SCVHP would be a potential conflict.

California sycamore alluvial woodland is a rare natural community type. Consequently, opportunities to preserve and restore or enhance sycamore alluvial woodland may be limited, posing a potential conflict between the Authority and the SCVHA. The SCVHP will need to preserve 54 acres of sycamore alluvial woodland if all impacts described in the SCVHP are incurred (County of Santa Clara et al. 2012). Because the Pacheco Creek Open Space Regional Reserve includes 8.2 acres of sycamore alluvial woodland,[9] the remaining need is 45.9 acres. However, because the project would permanently affect 0.4 acre, the remaining acquisition needed to achieve the goal and objectives of the SCVHP (if all impacts are incurred) is 45.5 acres.

The Authority would need to acquire 37.2 acres of California sycamore woodland to mitigate project impacts. Therefore, the combined acquisition need for the project and the HCP is 82.7 acres. Based on mapping by H.T. Harvey (SFEI and H. T. Harvey 2017) and the Authority (2016), it is estimated that there are 2,544 acres of available (unprotected) lands with opportunity for California sycamore woodland preservation and enhancement, 1,814 acres of which are in the Pajaro River HUC-8 watershed (where the impact would occur) and 730 acres of which are in the nearby Coyote Creek HUC-8 watershed. The combined mitigation need for the SCVHP and HSR of 82.7 acres totals 3.3 percent of the estimated available lands. Consequently, meeting the combined mitigation needs for the SCVHP and HSR is feasible and there is no conflict between

[9] The Pacheco Creek Open Space Regional Reserve also includes areas identified by SEFI and H.T. Harvey & Associates (2017) as suitable for restoration of sycamore alluvial woodland, thus potentially contributing to the future restoration goals (i.e., 10-acre contiguous stands) of the SCVHA.

the SCVHA and the Authority in terms of the limited availability of California sycamore woodland for preservation.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project would result in impacts within the Pacheco Creek Open Space Regional Reserve—an area protected in partial fulfillment of Action LAND-R3 of the SCVHP, resulting in a potential conflict. Project construction would affect riparian habitat within Pacheco Creek Open Space Regional Reserve, including a patch of California sycamore woodland. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Impact BIO#54: Conflict with Santa Clara Valley Greenprint

As shown in Table I-2 in Appendix I of the Biological and Aquatic Resources Technical Report (Authority 2020a), the analysis of potential conflicts from construction of the project identified one potential conflict related to Strategy 3 in the Greenprint. Strategy 3 includes the goal of protecting and maintaining connections between large open-space parcels to provide large habitat blocks, critical linkages, and climate resilience.

In addition, the Greenprint identifies 10 conservation focus areas: Baylands, Upper Penitencia Creek/East Foothills, Upper Alameda Creek, Coyote Ridge, Coyote Valley, Upper Coyote Creek, Southern Santa Cruz Mountains, Sargent Hills, UPR, and Pacheco Creek. Of these areas, only the Coyote Valley, UPR, and Coyote Creek have any potential to be affected by the project (all alternatives). The Greenprint sets forth no quantitative goals or strategies designated for any of these areas; rather, “the Valley Greenprint will be implemented through a series of strategic implementation plans that will identify specific high-priority initiatives and actions” (SCVOSA 2014). Strategic implementation plans for these three areas have not yet been prepared. Accordingly, there is no potential conflict with the Greenprint with regard to impacts on conservation focus areas.

Certain land parcels—the contiguous Bloomfield North and Bloomfield South easements—have already been protected by the SCVOSA and accordingly constitute functional elements in implementation of the Greenprint. Alternative 3 would bisect both parcels with a guideway on viaduct and part of the footprint for the existing Gilroy Station. These parcels, however, have been protected consistent with the agricultural lands protection goal of the Greenprint, rather than with its habitat conservation goals. Therefore, impacts on these parcels are not evaluated.

The project would not prevent the successful implementation of any Greenprint strategy and would not preclude implementation of the Greenprint in any of the conservation focus areas that would be affected by the project, nor would the impacts on conservation parcels result in a substantial impact on Greenprint implementation. Accordingly, it follows that the project alternatives would not conflict with implementation of the Greenprint.

CEQA Conclusion

The impact under CEQA would be less than significant for all four alternatives because, while the Greenprint sets forth goals calling for maintaining and protecting connectivity for wildlife movement, it has not established specific or quantitative targets. An identified area—the contiguous Bloomfield North and Bloomfield South parcels—has been protected under agricultural conservation easements rather than conservation plan protections. Accordingly, in the absence of quantitative targets, the project would not conflict with quantitative targets. Because project mitigation measures are designed to maintain connectivity for wildlife to the extent feasible, the project is not inconsistent with the Greenprint. Therefore, CEQA does not require mitigation.

Impact BIO#55: Conflict with Coyote Valley Linkage

As shown in Table I-3 in Appendix I of the Biological and Aquatic Resources Technical Report (Authority 2020a), the construction of the project alternatives would result in potential conflicts with recommended wildlife crossing modifications proposed under the Coyote Valley Linkage.

The Coyote Valley Linkage identified 24 wildlife crossing modifications, of which 11 would be potentially affected by the project alternatives (Table 3.7-23).

Table 3.7-23 Summary of Potential Conflicts with Wildlife Crossing Modifications Described in the Coyote Valley Linkage

Recommended Crossing Modification	Summary of Potential Impacts
Metcalf Bridge is a restoration opportunity to convert the entire roadway to a wildlife crossing by vegetating one or more lanes.	Under Alternatives 1 and 3, the alignment would be on viaduct in this location. Monterey Road would be shifted east by approximately 40 feet. An overpass in this location would have to be raised to span the elevated track and provide the necessary clearance over the OCS (27 feet). In addition, the span would have to be longer to cross the additional width created by the HSR footprint. Alternative 2 would be at grade, resulting in the need for the UPRR to be shifted west by approximately 50–75 feet (depending on the exact location); Alternative 4 is also at grade, but would not result in the need for a shift because the HSR footprint occurs within the UPRR right-of-way. An overpass in this location would have to be raised to span HSR with the necessary clearance over the OCS (27 feet). In addition, the span would have to be longer to cross the additional width created by the HSR footprint. While implementation of HSR may result in a wildlife overpass that is incrementally longer under Alternatives 1, 2, and 3, all alternatives include a new wildlife underpass under HSR, UPRR, and Monterey Road near Tulare Swale, just south of Metcalf Canyon Road, and enhancements to the Fisher Creek undercrossing.
Monterey Road would involve the replacement of portions of the existing median barrier with a barrier that is more permeable to wildlife.	Alternatives 1 and 3 would replace the existing impermeable barrier with one that includes 5-foot-wide breaks approximately every 0.3 mile to allow wildlife movement across Monterey Road. Alternative 2 would be on embankment along the Monterey Road corridor and would be continuously fenced; the fencing would not be permeable to wildlife that currently moves through openings in the existing Monterey Road barrier at certain roadway intersections. Alternative 4 would be at grade, predominantly within the existing UPRR right-of-way along the Monterey Road corridor, and would be continuously fenced except where there are breaks at at-grade roadway crossings. Under all alternatives, a new wildlife underpass under HSR, UPRR, and Monterey Road would be created near Tulare Swale, just south of Metcalf Canyon Road, and enhancements would be made to the Fisher Creek culvert. Under Alternatives 1 and 2, new underpasses under HSR, UPRR, and Monterey Road would be created at the following Monterey Road intersections: Emado Road, Laguna Avenue/Fisher Road, Richmond Avenue, Fox Lane, Paquita Espana Court, Kalana Avenue, and Live Oak Avenue.
Fisher Creek and Monterey Road culvert is a restoration opportunity to remove riprap and reengineer to make the culvert more permeable to wildlife.	Under Alternatives 1 and 3, the Fisher Creek culvert under Monterey Road would be lengthened by approximately 35–40 feet but the culverts under UPRR, HSR and Monterey Road would be increased in width and height resulting in an increase in openness (width x height / length); an increase in openness is considered an improvement for wildlife movement. The greater the openness, the greater the potential for use by larger animals such as mountain lions and deer. Under Alternative 2, a culvert would be placed between the existing structures under UPRR and Monterey Road, extending the length of the proposed culvert by approximately 50–75 feet. Under Alternatives 2 and 4, the Fisher Creek culvert would be increased in height and width to improve openness from existing conditions.
Metcalf (#1) would be an overpass approximately 175 feet long.	See summary above for Metcalf Bridge.

Recommended Crossing Modification	Summary of Potential Impacts
Tulare Swale (#3) would be an underpass approximately 175–200 feet long.	As described above, a new undercrossing comprised of three culverts, each between 8 and 11 feet high, 30–40 feet wide and 175–200 feet long, would be constructed as part of HSR under all four alternatives.
Fisher Creek (#4) would entail modifications to an existing underpass to reduce seasonal flooding.	Under all alternatives, existing and new Fisher Creek culverts would maintain the existing hydrologic condition. The project would increase the engineering complexity and cost of modifications to the existing underpass to improve conveyance of seasonal flood flows.
Blanchard (#5) would entail an underpass approximately 125 feet long.	Under Alternatives 1 and 3, an underpass in this location would have to be extended by approximately 35–40 feet and avoid placement directly under a viaduct footing; under Alternative 2, an underpass in this location would have to be lengthened by approximately 50–75 feet. Alternative 4 would not require any changes to the design or dimensions of an underpass at Blanchard Road. An increase in the undercrossing length under Alternatives 1, 2, or 3 would result in additional engineering complexity and cost. After evaluation of feasibility and functionality of a wildlife undercrossing in this location under Alternatives 2 and 4, one was not proposed at Blanchard Road. Emado Road was deemed a more appropriate location.
Emado (#6) would entail an underpass approximately 175 feet long.	Under Alternatives 1 and 3, an underpass in this location would have to be extended by approximately 35–40 feet and avoid placement directly under a viaduct footing; under Alternative 2, an underpass in this location would have to be lengthened by approximately 50–75 feet. Alternative 4 would not require any changes to the design or dimensions of an underpass at Emado Road. Under Alternatives 2 and 4, a wildlife undercrossing 15 feet high and 40 feet wide would be constructed in the vicinity of Emado Road.
Bailey (#7) would entail an overpass (or an underpass; see below for an evaluation of the underpass) (no detail on length provided in the Coyote Valley Linkage).	Under Alternatives 1 and 3, the alignment would be on viaduct in this location. Monterey Road would be shifted east by approximately 40 feet. An overpass for wildlife in this location would have to be raised to span the elevated track and provide the necessary clearance over the OCS (27 feet) under Alternatives 1 and 3. In addition, the span would have to be longer to cross the additional width created by the HSR footprint. Alternative 2 would be at grade, resulting in the need for the UPRR to be shifted west by approximately 50–75 feet (depending on the exact location); Alternative 4 would be at grade within the UPRR right-of-way and would not require a shift. An overpass in this location under Alternatives 2 and 4 would have to be raised to span HSR with the necessary clearance over the OCS (27 feet). In addition, the span would have to be longer to cross the additional width created by the HSR footprints of Alternatives 1, 2, and 3.
Bailey (#7) would entail an underpass (or an overpass; see above for an evaluation of the overpass) (no detail on length provided in the Coyote Valley Linkage).	Under Alternatives 1 and 3, an underpass in this location would have to be extended by approximately 35–40 feet to avoid placement directly under a viaduct footing; under Alternative 2, an underpass in this location would have to be lengthened by approximately 50–75 feet. Alternative 4 would not require lengthening. A wildlife undercrossing is not proposed at Bailey Road, but undercrossings are proposed north and south of Bailey Road at Emado and Laguna Avenues, respectively.

Recommended Crossing Modification	Summary of Potential Impacts
Laguna (#8) would entail an underpass less than 200 feet in length.	Under Alternatives 1 and 3, an underpass in this location would have to be extended by approximately 35–40 feet and avoid placement directly under a viaduct footing; under Alternative 2, an underpass in this location would have to be lengthened by approximately 50–75 feet. No lengthening would be needed under Alternative 4. Under Alternatives 2 and 4, a wildlife undercrossing 15 feet high and 40 feet just south of Laguna Avenue (Fisher Road) is part of the proposed project.

HSR = high-speed rail
ROW = right-of-way
OCS = overhead contact system
UPRR = Union Pacific Railroad

Impacts on the wildlife crossing modifications proposed under the Coyote Valley Linkage vary with alternative as shown in Table 3.7-23. In locations where a specific length is proposed, the project alternatives would necessitate increasing the length of the crossings. Generally, Alternative 2 would increase the lengths more than Alternatives 1, 3, or 4. Additionally, all project alternatives would increase the complexity and cost of implementing the crossing modifications.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project would conflict directly with the provisions of an adopted HCP. The project alternatives could potentially conflict with wildlife crossing locations recommended by the Coyote Valley Linkage to various degrees, but the project would effectively implement most of the study recommendations. Mitigation measures to address this impact are identified in Section 3.7.10, CEQA Significance Conclusions. Section 3.7.8, Mitigation Measures, describes these measures in detail.

Operations Impacts

Project operations are not expected to have any conflicts with the SCVHP, Coyote Valley Linkage, or the Greenprint. Therefore, the project alternatives would not have any impacts on an approved HCP.

3.7.8 Mitigation Measures

The mitigation measures described in this section would be implemented to address impacts on biological and aquatic resources. Terms and conditions of permits issued by the USFWS, CDFW, USACE, and SWRCB would also be implemented. Table 3.7-24 shows the application of the mitigation measures by alternative. The majority of the mitigation measures described in this section do not involve ground disturbance or other activities and thus are not likely to result in any secondary impacts. Several measures—those which would involve ground disturbance—could result in secondary impacts; these are discussed where appropriate in this section.

In response to comments received on the Draft EIR/EIS and the Revised/Supplemental Draft EIR/EIS, the Authority has also included a new program-level measure in this Final EIR/EIS to reiterate and support a substantial mitigation requirement related to the GEA.

Table 3.7-24 Mitigation Measures for Impacts on Biological and Aquatic Resources by Alternative

Mitigation Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Program-Level Measures				
BIO-MM#P1: Provide Compensatory Mitigation for Impacts on the Grasslands Ecological Area	X	X	X	X
Project-Level Measures				
BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan	X	X	X	X
BIO-MM#2: Prepare and Implement a Weed Control Plan	X	X	X	X
BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones	X	X	X	X
BIO-MM#4: Conduct Monitoring of Construction Activities	X	X	X	X
BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds	X	X	X	X
BIO-MM#6: Establish and Implement a Compliance Reporting Program	X	X	X	X
BIO-MM#7: Conduct Botanical Surveys for Special-Status Plant Species and Special-Status Plant Communities	X	X	X	X
BIO-MM#8: Prepare and Implement Plan for Salvage, Relocation, and/or Propagation of Special-Status Plant Species	X	X	X	X
BIO-MM#9: Prepare and Implement a Groundwater Adaptive Management and Monitoring Plan	X	X	X	X
BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat	X	X	X	X
BIO-MM#11: Implement Measures to Minimize Impacts during Off-Site Habitat Restoration, or Enhancement, or Creation on Mitigation Sites	X	X	X	X
BIO-MM#12: Provide Compensatory Mitigation for Impacts on Listed Plant Species	X	X	X	X
BIO-MM#13: Implement Work Stoppage	X	X	X	X
BIO-MM#14: Avoid Direct Impacts on Bay Checkerspot and Monarch Butterfly Host Plants	X	X	X	X
BIO-MM#15: Prepare and Implement Bay Checkerspot Butterfly Protection Plan	X	X	X	X
BIO-MM#16: Provide Compensatory Mitigation for Impacts on Bay Checkerspot Butterfly Habitat	X	X	X	X

Mitigation Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
BIO-MM#17: Conduct Pre-Construction Surveys for Vernal Pool Wildlife Species	X	X	X	X
BIO-MM#18: Implement Seasonal Vernal Pool Work Restriction	X	X	X	X
BIO-MM#19: Implement and Monitor Vernal Pool Avoidance and Minimization Measures within Temporary Impact Areas	X	X	X	X
BIO-MM#20: Provide Compensatory Mitigation for Impacts on Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp Habitat	X	X	X	X
BIO-MM#21: Implement Avoidance Measures for Elderberry Shrubs outside Permanent Impact Areas	X	X	X	X
BIO-MM#22: Provide Compensatory Mitigation for Impacts on Valley Elderberry Longhorn Beetle Habitat	X	X	X	X
BIO-MM#23: Conduct Surveys and Implement Avoidance Measures for Crotch Bumble Bee	X	X	X	X
BIO-MM#24: Provide Compensatory Mitigation for Impacts on Crotch Bumble Bee	X	X	X	X
BIO-MM#25: Prepare Plan for Dewatering and Water Diversions	X	X	X	X
BIO-MM#26: Prepare and Implement a Fish Rescue Plan	X	X	X	X
BIO-MM#27a: Implement General Protection Measures for Fish	X	X	X	X
BIO-MM#27b: Work Windows for Fish	X	X	X	X
BIO-MM#27c: Prepare and Implement an Underwater Sound Control Plan	X	X	X	X
BIO-MM#28: Provide Compensatory Mitigation for Permanent Impacts on Steelhead Habitat and Essential Fish Habitat for Pacific Coast Salmon	X	X	X	X
BIO-MM#29: Conduct Pre-Construction Surveys for California Tiger Salamander	X	X	X	X
BIO-MM#30: Implement Avoidance and Minimization Measures for California Tiger Salamander	X	X	X	X
BIO-MM#31: Provide Compensatory Mitigation for Impacts on California Tiger Salamander Habitat	X	X	X	X
BIO-MM#32: Conduct Pre-Construction Surveys and Implement Avoidance and Minimization Measures for California Red-Legged Frog	X	X	X	X

Mitigation Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
BIO-MM#33: Provide Compensatory Mitigation for Impacts on California Red-Legged Frog Habitat	X	X	X	X
BIO-MM#34: Conduct Pre-Construction Surveys and Implement Avoidance and Minimization Measures for Foothill Yellow-Legged Frog	X	X	X	X
BIO-MM#35: Provide Compensatory Mitigation for Impacts on Foothill Yellow-Legged Frog Habitat	X	X	X	X
BIO-MM#36: Conduct Pre-Construction Surveys for Special-Status Reptiles and Amphibians	X	X	X	X
BIO-MM#37: Implement Avoidance and Minimization Measures for Special-Status Reptiles and Amphibians	X	X	X	X
BIO-MM#38: Conduct Surveys for Blunt-Nosed Leopard Lizard	X	X	X	X
BIO-MM#39: Implement Avoidance Measures for Blunt-Nosed Leopard Lizard	X	X	X	X
BIO-MM#40: Provide Compensatory Mitigation for Impacts on Blunt-Nosed Leopard Lizard Habitat	X	X	X	X
BIO-MM#41: Conduct Pre-Construction Surveys and Implement Avoidance and Minimization Measures for Giant Garter Snake	X	X	X	X
BIO-MM#42: Provide Compensatory Mitigation for Impacts on Giant Garter Snake Habitat	X	X	X	X
BIO-MM#43: Conduct Pre-Construction Surveys and Delineate Active Nest Buffers for Breeding Birds	X	X	X	X
BIO-MM#44: Implement Avoidance and Minimization Measures for Mountain Plover and Sandhill Crane	X	X	X	X
BIO-MM#45: Conduct Surveys for Burrowing Owl	X	X	X	X
BIO-MM#46: Implement Avoidance and Minimization Measures for Burrowing Owl	X	X	X	X
BIO-MM#47: Provide Compensatory Mitigation for Loss of Active Burrowing Owl Burrows and Habitat	X	X	X	X
BIO-MM#48: Conduct Pre-Construction Surveys for Eagles	X	X	X	X
BIO-MM#49: Implement Avoidance Measures for Active Eagle Nests	X	X	X	X

Mitigation Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
BIO-MM#50: Provide Compensatory Mitigation for Loss of Eagle Nests	X	X	X	X
BIO-MM#51: Implement Avoidance Measures for California Condor	X	X	X	X
BIO-MM#52: Conduct Pre-Construction Surveys and Monitoring for Raptors	X	X	X	X
BIO-MM#53: Conduct Surveys for Swainson's Hawk Nests	X	X	X	X
BIO-MM#54: Implement Avoidance and Minimization Measures for Swainson's Hawk Nests	X	X	X	X
BIO-MM#55: Provide Compensatory Mitigation for Loss of Swainson's Hawk Nesting Trees and Habitat	X	X	X	X
BIO-MM#56: Conduct Surveys and Implement Avoidance Measures for Active Tricolored Blackbird Nest Colonies	X	X	X	X
BIO-MM#57: Provide Compensatory Mitigation for Impacts on Tricolored Blackbird Habitat	X	X	X	X
BIO-MM#58: Provide Compensatory Mitigation for Impacts on Waterfowl, Shorebird, and Sandhill Crane Habitat	X	X	X	X
BIO-MM#59: Conduct Pre-Construction Surveys for San Joaquin Kit Fox	X	X	X	X
BIO-MM#60: Implement San Joaquin Kit Fox Avoidance and Minimization Measures	X	X	X	X
BIO-MM#61: Provide Compensatory Mitigation for Impacts on San Joaquin Kit Fox Habitat	X	X	X	X
BIO-MM#62: Implement Avoidance and Minimization Measures for Fresno Kangaroo Rat	X	X	X	X
BIO-MM#63: Provide Compensatory Mitigation for Impacts on Fresno Kangaroo Rat Habitat	X	X	X	X
BIO-MM#64: Conduct Pre-Construction Surveys for American Badger Den Sites and Implement Avoidance and Minimization Measures	X	X	X	X
BIO-MM#65: Conduct Pre-Construction Surveys for Ringtail and Ringtail Den Sites and Implement Avoidance Measures	X	X	X	X
BIO-MM#66: Conduct Pre-Construction Surveys for Dusky-Footed Woodrat and Implement Avoidance Measures	X	X	X	X
BIO-MM#67: Conduct Pre-Construction Surveys for Special-Status Bat Species	X	X	X	X

Mitigation Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
BIO-MM#68: Implement Bat Avoidance and Relocation Measures	X	X	X	X
BIO-MM#69: Implement Bat Exclusion and Deterrence Measures	X	X	X	X
BIO-MM#70: Prepare and Implement an Annual Vegetation Control Plan	X	X	X	X
BIO-MM#71: Restore Temporary Riparian Impacts	X	X	X	X
BIO-MM#72: Provide Compensatory Mitigation for Permanent Impacts on Riparian Habitat	X	X	X	X
BIO-MM#73: Restore Aquatic Resources Subject to Temporary Impacts	X	X	X	X
BIO-MM#74: Prepare and Implement a Compensatory Mitigation Plan for Impacts on Aquatic Resources	X	X	X	X
BIO-MM#75: Implement Transplantation and Compensatory Mitigation for Protected Trees	X	X	X	X
BIO-MM#76a: Minimize Impacts on Wildlife Movement during Construction	X	X	X	X
BIO-MM#76b: Minimize Impacts on Wildlife Movement in the Western Pacheco Pass Region	X	X	X	X
BIO-MM#77a: Design Wildlife Crossings to Facilitate Wildlife Movement	X	X	X	X
BIO-MM#77b: Monitoring and Adaptive Management of Wildlife Crossings	X	X	X	X
BIO-MM#78: Establish Wildlife Crossings at Embankment in West Slope of Pacheco Pass	X	X	X	X
BIO-MM#79a: Provide Wildlife Movement between the Santa Cruz Mountains and Diablo Range	X	X	X	X
BIO-MM#79b: Provide Wildlife Movement between the Diablo Range and Inner Coast Range	X	X	X	X
BIO-MM#80: Minimize Permanent Intermittent Noise, Visual, and Train Strike Impacts on Wildlife Movement	X	X	X	X
BIO-MM#81: Minimize Permanent Intermittent Impacts on Terrestrial Species Wildlife Movement	X	X	X	X
BIO-MM#82: Minimize Permanent Intermittent Impacts on Aerial Species Wildlife Movement	X	X	X	X
BIO-MM#83: Implement Removal of Carrion that May Attract Condors and Eagles	X	X	X	X

Mitigation Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
BIO-MM#84a: Avoid and Minimize Impacts on Conservation Areas	X	X	X	X
BIO-MM#84b: Provide Compensatory Mitigation for Impacts on Conservation Areas	X	X	X	X
BIO-MM#85: Provide Compensatory Mitigation for Impacts on California Sycamore Woodland at the Pacheco Creek Open Space Regional Reserve	X	X	X	X
BIO-MM#86: Provide Compensatory Mitigation for Impacts on Monarch Butterfly Habitat	X	X	X	X
BIO-MM#87: Conduct Pre-Construction Surveys and Implement Avoidance and Minimization Measures for Mountain Lion Dens	X	X	X	X
BIO-MM#88: Provide Compensatory Mitigation for Impacts on Mountain Lion Habitat	X	X	X	X
BIO-MM#89: Minimize the Impacts of Operational Lighting on Wildlife Species	X	X	X	X

3.7.8.1 Program-Level Measures

BIO-MM#P1: Provide Compensatory Mitigation for Impacts on the Grasslands Ecological Area

To fulfill a program-level commitment set out in the Bay Area to Central Valley Final Program EIR/EIS (2008) to preserve habitat and open space values and offset impacts to wetlands, sensitive plant and wildlife species, and other biological resources in and around the GEA and other areas along the alignment, the Authority or entities acting on behalf of the Authority will acquire agricultural, conservation or open space easements on 10,000 acres of land generally located within or adjacent to the GEA.

The Authority will provide this compensatory mitigation by initially implementing the requirements identified in BIO-MM#s 12, 16, 20, 22, 24, 28, 31, 33, 35, 40, 42, 47, 50, 55, 57, 58, 61, 63, 72, 74, 78, 79, 84, and 85. To the extent the compensatory mitigation for biological and aquatic resources required under the project-level mitigation measures results in less than 10,000 acres protected under easements, or by other means, on lands generally located within or adjacent to the GEA, the Authority will acquire agricultural, conservation, or open space easements to ensure a total of 10,000 acres of compensatory mitigation as follows:

The easements will be acquired from willing sellers, and to the extent feasible, will be located generally within or adjacent to the GEA, with a focus on areas around Los Banos and Volta. To the extent it is not feasible to acquire easements on 10,000 acres in the vicinity of the GEA, easements will be acquired in other areas of the San Jose to Merced Project Section, including in the Diablo Range area located between South Santa Clara Valley and San Joaquin Valley and in and around the Central Valley Wye portion of the Project Section. The eventual locations of easements will be coordinated with USFWS, CDFW, and the Grassland Water District. Acquisition of easements will be completed within 5 years of the start of operations for the project section, to the extent feasible.

3.7.8.2 Project-Level Measures

BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan

Prior to any ground-disturbing activity, the Project Biologist will prepare a restoration and revegetation plan (RRP) to address temporary impacts resulting from ground-disturbing activities within areas that potentially support special-status species, wetlands, and/or other aquatic resources. Restoration activities may include, but not be limited to: grading landform contours to approximate pre-disturbance conditions, stockpiling and spreading topsoil, removing invasive plant species, revegetating disturbed areas with native plant species (including host plants for butterflies), and using certified weed-free straw and mulch. The Authority will implement the RRP in all temporarily disturbed areas outside of the permanent right-of-way that potentially support special-status species, wetlands, and/or other aquatic resources.

Consistent with Section 1415 of the Fixing America's Surface Transportation Act (FAST Act) restoration activities will provide habitat for native pollinators through plantings of native forbs and grasses. The Project Biologist will obtain a locally sourced native seed mix. The restoration success criteria will include limits on invasive species, as defined by the California Invasive Plant Council, to an increase no greater than 10 percent compared to the pre-disturbance condition, or to a level determined through a comparison with an appropriate reference site consisting of similar natural communities and management regimes. The RRP will outline at a minimum:

- Procedures for documenting pre-construction conditions for restoration purposes.
- Sources of plant materials and methods of propagation.
- Specification of parameters for maintenance and monitoring of re-established habitats, including weed control measures, frequency of field checks, and monitoring reports for temporary disturbance areas.
- Specification of success criteria for re-established plant communities.
- Specification of the remedial measures to be taken if success criteria are not met.
- Methods and requirements for monitoring restoration/replacement efforts, which may involve a combination of qualitative and/or quantitative data gathering.
- Maintenance, monitoring, and reporting schedules, including an annual report due to the Authority by January 31st of the following year.

The RRP will be submitted to the Authority and regulatory agencies, as defined in the conditions of regulatory authorizations, for review and approval.

BIO-MM#2: Prepare and Implement a Weed Control Plan

Prior to any ground-disturbing activity during the construction phase, the Project Biologist will develop a weed control plan (WCP), subject to review and approval by the Authority. The purpose of the WCP is to establish approaches to minimize and avoid the spread of invasive weeds during ground-disturbing activities during construction and O&M.

The WCP will include, at a minimum, the following:

- A requirement to delineate ESAs in the field prior to weed control activities.
- A schedule for weed surveys to be conducted in coordination with the BRMP.
- Success criteria for invasive weed control. The success criteria will be linked to the BRMP standards for on-site work during ground-disturbing activities. In particular, the criteria will establish limits on the introduction and spread of invasive species, as defined by the California Invasive Plant Council, to less than or equal to the pre-disturbance conditions in the area temporarily affected by ground-disturbing activities. If invasive species cover is found to exceed pre-disturbance conditions by greater than 10 percent or is 10 percent greater than levels at a similar, nearby reference site, a control effort will be implemented. If the target, or other success criteria identified in the WCP, has not been met by the end of the

WCP monitoring and implementation period, the Authority will continue the monitoring and control efforts, and remedial actions will be identified and implemented until the success criteria are met.

- Provisions for consistency between the WCP and the RRP, including verification that the RRP includes measures to minimize the risk of the spread and/or establishment of invasive species and reflects the same revegetation performance standards as the WCP.
- Identification of weed control treatments, including permitted herbicides and manual and mechanical removal methods.
- Timeframes for weed control treatment for each plant species.
- Identification of fire prevention measures.

BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones

Prior to any ground-disturbing activity in a work area, the Project Biologist will use flagging to mark ESAs that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures. ESAs will be located around the perimeter of the special-status species or aquatic resources within the work area so that they are avoided during construction. The Project Biologist will also direct the installation of wildlife exclusion fencing (WEF) by the contractor to prevent special-status wildlife species from entering work areas. The WEF will be installed below grade (e.g., 6–10 inches below grade) and will have exit doors to allow animals that may be inside an enclosed area to leave the area. The Project Biologist will delineate the ESAs and WEF based on the results of habitat mapping or modeling and any pre-construction surveys, and in coordination with the Authority. The Project Biologist will also direct the installation of construction exclusionary fencing (exclusionary fencing) at the boundary of the work area, as appropriate, to exclude special-status species or aquatic resources from the work area during the construction period. The Project Biologist will regularly inspect and maintain the ESA, WEF, and exclusionary fencing.

The ESA, WEF, and exclusionary fencing locations will be identified and depicted on an exclusion fencing exhibit. The purpose of the ESAs and WEF will be explained at WEAP training and the locations of the ESA and WEF areas will be noted during worker tailgate sessions.

BIO-MM#4: Conduct Monitoring of Construction Activities

During any initial ground-disturbing activity, the Project Biologist will be present in the work area to verify compliance with avoidance and minimization measures, to establish ESAs, and to direct the installation of WEF and construction exclusion fencing by the contractor.

BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds

Prior to any ground-disturbing activities, the Project Biologist will check that appropriate measures have been instituted to restrict project vehicle traffic within the project footprint to established roads, construction areas, and other permissible areas. The Project Biologist will establish vehicle speed limits of no more than 15 mph for unimproved access roads and for temporary and permanent construction areas within the project footprint. The Project Biologist will also direct that access routes be flagged and marked and that measures be adopted to prevent off-road vehicle traffic.

BIO-MM#6: Establish and Implement a Compliance Reporting Program

The Project Biologist will prepare monthly and annual reports documenting compliance with all IAMFs, mitigation measures, and requirements set forth in regulatory agency authorizations. The Authority will review and approve all compliance reports prior to submittal to the regulatory agencies. Reports will be prepared in compliance with the content requirements outlined in the regulatory agency authorizations.

Pre-activity survey reports will be submitted within 15 days of completing the surveys and will include:

- Location(s) of where pre-activity surveys were completed, including latitude and longitude, Assessor Parcel Number, and HST parcel number.
- Written description of the surveyed area. A figure of each surveyed location will be provided that depicts the surveyed area and survey buffers over an aerial image.
- Date, time, and weather conditions observed at each location.
- Personnel who conducted the pre-activity surveys.
- Verification of the accuracy of the Authority's habitat mapping at each location, provided in writing and on a figure.
- Observations made during the survey, including the type and locations (written and GIS) of any sensitive resources detected.
- Identification of relevant measures from the BRMP to be implemented as a result of the survey observations.

Daily compliance reports will be submitted to the Authority via the Environmental Mitigation Management and Assessment system (EMMA) within 24 hours of each monitoring day. Noncompliance events will be reported to the Authority the day of the occurrence. Daily compliance reports will include:

- Date, time, and weather conditions observed at each location where monitoring occurred.
- Personnel who conducted compliance monitoring.
- Project activities monitored, including construction equipment in use.
- Compliance conditions implemented successfully.
- Noncompliance events observed.

Daily compliance reports will also be included in the monthly compliance reports, which will be submitted to the Authority by the 10th of each month and will include:

- Summary of construction activities and locations during the reporting month, including any noncompliance events and their resolution, work stoppages, and take of threatened or endangered species.
- Summary of anticipated project activities and work areas for the upcoming month.
- Tracking of impacts on suitable habitats for each threatened and endangered species identified in USFWS and CDFW authorizations, including:
  - An accounting of the number of acres of habitats for which we provide compensatory mitigation that has been disturbed during the reporting month, and
  - An accounting of the cumulative total number of acres of threatened and endangered species habitat that has been disturbed during the project period.
- Up-to-date GIS layers, associated metadata, and photodocumentation used to track acreages disturbed.
- Copies of all pre-activity survey reports, daily compliance reports, and noncompliance/work stoppage reports for the reporting month.

Annual reports will be submitted to the Authority by the 20th of January and will include:

- Summary of all monthly compliance reports for the reporting year.
- A general description of the status of the project, including projected completion dates.
- All available information about project-related incidental take of threatened and endangered species.

- Information about other project impacts on the threatened and endangered species.
- A summary of findings from pre-construction surveys (e.g., number of times a threatened or endangered species or a den, burrow, or nest was encountered, location, if avoidance was achieved, if not, what other measures were implemented).
- Written description of disturbances to threatened and endangered species habitat within work areas, both for the preceding 12 months and in total since issuance of regulatory authorizations by USFWS and CDFW, and updated maps of all land disturbances and updated maps of identified habitat features suitable for threatened and endangered species within the project area.

In addition to the compliance reporting requirements outlined above, the following items will be provided for compliance documentation purposes:

- If agency personnel visit the project footprint in accordance with BIO-IAMF#2, the Project Biologist will prepare a memorandum within one day of the visit that memorializes the issues raised during the field meeting. This memorandum will be submitted to the Authority via EMMA. Any issues regarding regulatory compliance raised by agency personnel will be reported to the Authority and the contractor.
- Compliance reporting will be submitted to the Authority via EMMA in accordance with the report schedule. The Project Biologist will prepare and submit compliance reports that document the following:
  - Implementation and performance of the RRP described in BIO-MM#1
  - Summary of progress made regarding the implementation of the WCP described in BIO-MM#2
  - Compliance with BIO-MM#3
  - Compliance with BIO-IAMF#6
  - Compliance with BIO-IAMF#7
  - Compliance with BIO-IAMF#8
  - Compliance with BIO-IAMF#10
  - Compliance with BIO-MM#5
  - Compliance with BIO-IAMF#12
  - Compliance with BIO-IAMF#9
  - BMP field manual implementation and any recommended changes to construction site housekeeping practices outlined in BIO-IAMF#11
- Work stoppages and measures taken under BIO-MM#13 will be documented in a memorandum prepared by the Project Biologist and submitted to the Authority within 2 business days of the work stoppage.

BIO-MM#7: Conduct Botanical Surveys for Special-Status Plant Species and Special-Status Plant Communities

Prior to any ground-disturbing activity, the Project Biologist will conduct protocol-level surveys for special-status plant species and special-status plant communities within each work area consistent with *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Sensitive Natural Communities* (CDFW 2018c) and with *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants* (USFWS 2000) in all potentially suitable habitats. The Project Biologist will flag and record in GIS the locations of any observed special-status plant species and special-status plant communities and establish a 50-foot buffer from the perimeter of the occupied habitat or the specific habitat type required by the special-status plant species (if the specific habitat types

extended beyond the occupied habitat). If a smaller buffer is necessary due to other project constraints, the Authority will develop and implement a site-specific exclusion plan, in consultation with USFWS and CDFW.

BIO-MM#8: Prepare and Implement Plan for Salvage, Relocation, and/or Propagation of Special-Status Plant Species

Where relocation or propagation of special-status plant species is required by authorizations issued under FESA and/or CESA, the Project Biologist will collect seeds and plant materials and stockpile and segregate the top 4 inches of topsoil from locations within the work area prior to any ground-disturbing activities where special-status plant species were observed during surveys conducted under BIO-MM#1. Special-status plant species are those listed as threatened, endangered, or candidate under FESA; threatened, endangered, or candidate for listing under CESA; state-designated "Rare" species; and CRPR 1B and 2 species that were observed during surveys for use on off-site locations. Restoration locations will be chosen based on the *Policy on Mitigation Guidelines Regarding Impacts to Rare, Threatened, and Endangered Plants* (CNPS 1998). Suitable sites that may receive salvaged material include Authority mitigation sites, refuges, reserves, federal or state lands, and public/private mitigation banks.

The Project Biologist will prepare a plant species salvage plan to address monitoring, salvage, relocation and/or seed banking of special-status plant species. The plan will include provisions that address the techniques, locations, and procedures required for the collection, storage, and relocation of seed or plant material; collection, stockpiling, and redistribution of topsoil and associated seed. The plan will also include requirements related to success criteria, such as the plant survival and percent absolute cover of invasive species rated as "high" by the California Invasive Plant Council to be equal to or less than documented baseline conditions as well as maintenance, monitoring, implementation, adaptive management, and annual reporting. The plan will reflect conditions required under regulatory authorizations issued for federal or state-listed species. The Project Biologist will submit the plan to the Authority for review and approval.

BIO-MM#9: Prepare and Implement a Groundwater Adaptive Management and Monitoring Plan

To avoid, minimize and mitigate for potential impacts on wetlands, creeks, ponds, springs, riparian vegetation, special-status plant and wildlife species and protected trees as a result of hydrogeologic changes due to tunnel construction, the Authority will prepare and implement a groundwater adaptive management and monitoring plan (GAMMP) prior to, during, and after tunnel construction to implement the requirements described under HYD-MM#1 and as described below concerning biological resources. Prior to construction, the GAMMP will be submitted to the USFWS, CDFW, SWRCB, and Regional Water Quality Control Board (RWQCB) for review (and approval where applicable).

The purpose of the GAMMP relative to biological resources is to monitor groundwater-dependent biological resources within the tunnel groundwater study area to detect and remediate adverse effects on habitat function in a timely manner. Implementation of the GAMMP will provide information and data to identify hydrological, hydrogeological, and biological effects that may arise during HSR construction, if any, and trigger actions to offset any such impacts.

The GAMMP will include the following components, at a minimum, to avoid or minimize and address impacts on habitat for special-status species, aquatic resources, and protected trees:

- **Baseline inventory**—As allowed by private property owners, the Authority will establish baseline hydrologic conditions within the groundwater RSA (approximately 1.1 miles north and south of the tunnel alignment) through baseline data collection. Baseline surveys will characterize potential aquatic resources, including but not limited to mapping of wetland and riparian vegetation; hydroperiod (the duration of inundation); flow rates; area of feature; pond depth; the potential for special-status plant and animal species (e.g., California tiger salamander, California red-legged frog, foothill yellow-legged frog, western pond turtle, least

Bell's vireo, tricolored blackbird, and yellow-headed blackbird) and steelhead to occur; and potential groundwater dependent protected trees (e.g. oaks).[10]

- **Groundwater modeling**—The Authority will model groundwater hydrologic conditions and potential tunnel infiltration to further identify specific areas of probable effect on the water table, facilitate selection of appropriate monitoring locations, and prepare for the potential need to provide supplemental water infrastructure in advance of tunneling.
- **Pre-tunneling supplemental water infrastructure provision**—To maintain baseline water supply, the Authority will install water storage tanks or water lines in advance of tunneling on or near properties with wetlands, creeks, ponds, and springs subject to landowner approval. Water infrastructure may also be provided for upland protected trees susceptible to groundwater lowering in areas of predicted groundwater effects, but direct watering of protected trees may be utilized instead.
- **Construction monitoring**—The Authority will designate monitoring locations and methodologies for monitoring water levels, vegetation cover, special-status species habitat, and protected trees most likely to be affected by tunnel construction as indicated by hydrologic modeling. The Authority will monitor representative locations during periods when effects are most likely to occur. If effects (e.g., lowering water levels resulting in reduced habitat) are observed, the Authority will implement contingency plans that expand monitoring beyond the representative locations and increase monitoring frequency to capture the extent of potential effects on groundwater-dependent biological resources.
- **Supplemental water**—The Authority will prepare contingency plans to provide supplemental water as necessary to support riparian/aquatic vegetation, wildlife breeding cycles, aquatic wildlife, or protected tree health within the area of predicted effects determined through modeling or monitoring to be potentially affected by groundwater lowering. Seasonal variation as documented during the preconstruction baseline monitoring will be considered in establishing the amount of supplemental water. For all features, supplemental water will provide minimum flows and periods of inundation to match baseline conditions. The periods of supplemental water, in general, will likely be in periods of baseflow, which occurs in late spring, summer, and early fall outside of rain periods. For breeding habitats, the Authority will, at a minimum, supplement breeding habitat where necessary to maintain adequate depths for completion of the reproduction cycle (defined as the time by which juveniles are viable and mobile such that they can feasibly leave the breeding location). However, where breeding habitat is perennial or long-seasonal, then supplemental water will be provided as necessary to maintain the entire wetted period as determined through baseline monitoring. For nonbreeding movement and foraging habitat in creeks and streams, water will be provided to maintain seasonal flow similar to baseline conditions. Water will be provided as needed to sustain habitat conditions up to the point of baseline conditions until the qualified biologist determines it is appropriate to cease its provision. If supplemental water is provided from wells, the effects on water supply and habitat features will be managed to avoid and minimize potential disruption by the selection of well location, depth, flow rate, and the use of alternative supplies. Plans for supplemental water will also consider best practices related to supplemental water near oak trees. For example, oak trees will be irrigated only outside their root zone (i.e., beyond the dripline to a distance that is half the distance between the trunk and the dripline).
- **Contingency plan for supplemental water in areas outside of predicted area of effect**—The Authority will establish contingency procedures to provide supplemental water to wetlands, creeks, ponds, and springs to support riparian/aquatic vegetation, wildlife breeding

[10] The baseline inventory will be used to estimate groundwater levels below ground surface. Once the groundwater levels are identified, the area of potential effect to oaks can be identified (defined as areas with groundwater levels within 100 feet of the surface), and oaks within the area of potential groundwater effect can then be identified.

cycles, and aquatic wildlife as well as supplemental water to protected trees outside the area of predicted effects, if warranted by monitoring.

- **Temporary relocation**—The Authority will relocate aquatic species (e.g., California tiger salamander, California red-legged frog, foothill yellow-legged frog, western pond turtle) where unavoidable drying of aquatic breeding habitat will occur before salamanders and frogs have been able to metamorphose and maintaining the habitat with supplemental water is not feasible. The Authority will relocate these species, as allowed by USFWS and CDFW. If holding facilities are used, the Authority will return affected wildlife to affected aquatic areas after recovery of baseline hydrologic conditions.

- **Post-construction monitoring**—After construction, the Authority will monitor water levels and aquatic resource conditions of affected features twice annually (spring and summer) and affected protected trees for at least 5 years or as determined through consultation with USFWS and CDFW. As long as groundwater levels are demonstrated to be recovering, monitoring will continue until baseline conditions return or 5 years, whichever is longer. In the event that supplementary water is not successful at restoring aquatic resources and/or protected trees to baseline conditions in the post-construction period and off-site compensation is triggered, then monitoring may be waived for certain features if it is determined that there is no further utility for monitoring the specific feature. Once the Authority determines that conditions have returned to baseline conditions, monitoring will no longer be required.

- **Post-construction riparian or wetland restoration**—The Authority will restore any lost riparian or wetland vegetation that is not recovering on its own within 1 year of construction and is determined to be the result of tunnel construction through comparison to baseline conditions. Subject to landowner approval, such restoration will occur on site, or at a suitable location nearby if not feasible on site. The Authority will implement restoration of riparian or wetland restoration, as applicable, as defined in Mitigation Measures BIO-MM#71 and BIO-MM#73.

- **Post-construction compensation**—If the Authority determines through direct monitoring or data interpretation that substantial disruption (i.e., loss of 0.5 acre or greater) to habitat supporting special-status species has likely occurred during or after construction and that habitat restoration efforts did not achieve success criteria or that restoration was determined unfeasible, the Authority will compensate for this loss of habitat. In addition, if affected protected trees demonstrate substantial impairment to health or mortality after 5 years of monitoring, the Authority will compensate for affected protected trees with replacement on at least a 1:1 basis. The Authority will implement the compensation of suitable habitat, as applicable, as defined in Mitigation Measures BIO-MM#10, BIO-MM#12, BIO-MM#28, BIO-MM#31, BIO-MM#33, BIO-MM#35, BIO-MM#57, BIO-MM#72, BIO-MM#74 and BIO-MM#75.

BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat

The Authority will prepare an HMP that sets out the compensatory mitigation that will be provided to offset permanent and temporary impacts on federal and state-listed species and their habitat, fish and wildlife resources regulated under Section 1600 et seq. of the Cal. Fish and Game Code, and special-status species. Mitigation implemented under this measure will be consistent with and will be credited towards the 10,000-acre mitigation commitment in BIO-MM#P1 to preserve habitat and open space values and offset impacts on wetlands, sensitive plant and wildlife species, and other biological resources in and around the GEA and other areas along the alignment, and will help advance mitigation commitments at the program level, including mitigation intended to address impacts in the GEA.

Mitigation for temporary effects will be located on site and in-kind whenever feasible, and mitigation for permanent effects will be in-kind and located as close to the location of impact as feasible, especially where those impacts occur in natural areas, near areas known or likely to support wildlife movement, or near wildlife crossings that will be constructed as part of the rail (to contribute to the long-term function of the crossing). The Authority could also mitigate in other

locations farther from the location of the impact, if the mitigation sites are more appropriate or higher quality than those closer to the location of the impact.

The HMP will include the following:

- A description of the species and habitat types for which compensatory mitigation is being provided.
- A description of the methods used to identify and evaluate mitigation options. Mitigation options will include one or more of the following:
  - Purchase of mitigation credits from an agency-approved mitigation bank.
  - Protection of habitat through acquisition of fee-title or conservation easement and funding for long-term management of the habitat. Title to lands acquired in fee will be transferred to the most suitable landowner/manager in the region, which will be determined in coordination with conservation agencies and organizations, including CDFW. Conservation easements will be held by an entity approved in writing by the applicable regulatory agency. In circumstances where the Authority protects habitat through a conservation easement, the terms of the conservation easement will be subject to approval of the applicable regulatory agencies, and the conservation easement will identify applicable regulatory agencies as third-party beneficiaries with a right of access to the easement areas.
  - Payment to an existing in-lieu fee program.
- A summary of coordination with local conservation agencies and organizations to ensure that the mitigation options promote and do not conflict with the conservation goals in the region.
- A summary of the estimated direct permanent and temporary impacts on species and species habitat.
- A description of the process that will be used to confirm impacts. Actual impacts on species and habitat could differ from estimates. Should this occur, adjustments will be made to the compensatory mitigation that will be provided. Adjustments to impact estimates and compensatory mitigation will occur in the following circumstances:
  - Impacts on species (typically measured as habitat loss) are reduced or increased as a result of changes in project design
  - Pre-construction site assessments indicate that habitat features are absent (e.g., because of errors in land cover mapping or land cover conversion)
  - The habitat is determined to be unoccupied based on negative species surveys
  - Impacts initially categorized as permanent qualify as temporary impacts
- Adjustments to compensatory mitigation requirements through this process will not result in a reduction of the commitment in BIO-MM#P1 to ensure acquisition of agricultural, conservation, or open space easements on a total of 10,000 acres of land.
- An overview of the strategy for mitigating effects on species. The overview will indicate the ratios set forth in the specific species and habitat compensatory mitigation measures and the total amount of habitat that will be protected pursuant to those ratios (noting that if a permitting agency requires a higher ratio than this document, the future permit condition ratio will apply in implementation). The overview will also set out the process for ensuring implementation of BIO-MM#P1 (the program-level commitment to acquire easements on 10,000 acres of land generally located within or adjacent to the GEA after accounting for compensatory mitigation achieved through project-level mitigation measures).

- A description of habitat restoration or enhancement projects, if any, as provided by the habitat restoration mitigation measure, that will contribute to compensatory mitigation commitments.
- A description of the success criteria that will be used to evaluate the performance of habitat restoration or enhancement projects, and a description of the types of monitoring that will be used to verify that such criteria have been met.
- A description of the management actions that will be used to maintain the habitat on the mitigation sites, and the funding mechanisms for long-term management.
- A description of adaptive management approaches, if applicable, that will be used in the management of species habitat.
- A description of financial assurances that will be provided to demonstrate that the funding to implement mitigation is assured.

Impacts from Implementing Mitigation Measure BIO-MM#10

Some of the activities and actions that would be implemented under BIO-MM#10, especially those involving ground disturbance, could result in impacts similar to those described in Section 3.7.7. Specifically, direct and indirect impacts on special-status plant and wildlife species (e.g., California tiger salamander, red-legged frog, and foothill yellow-legged frog), special-status plant communities, and aquatic resources could occur where such resources are present on the mitigation sites. BIO-MM#11, which requires a site assessment and appropriate regulatory authorizations, would be implemented at compensatory mitigation sites to reduce or avoid impacts on these resources.

Restoration and enhancement of aquatic resources may result in the permanent conversion of grassland to wetland or riparian habitat. While such activities will be beneficial for special-status vernal pool or riparian species (for example), they will result in a small but measurable loss of upland habitat that could support denning, foraging, or movement by San Joaquin kit fox; nesting and foraging by burrowing owl, short-eared owl, grasshopper sparrow, and northern harrier; and foraging by golden eagle and white-tailed kite.

The HMP will be designed, implemented, and monitored consistent with the terms and conditions of the USACE Section 404 Permit, SWRCB Section 401 water quality certification, Cal. Fish and Game Code Section 1600 et seq. streambed alteration agreement, and FESA and CESA as they apply to their jurisdiction and resources on-site. Potential impacts on site-specific hydrology and the downstream resources will be evaluated as a result of implementation of the restoration-related activity. Site-specific BMPs and a stormwater pollution prevention plan will be implemented as appropriate.

Environmental impacts on other resource categories (beyond biological resources) could result from implementing restoration activities at mitigation sites. These impacts will result from transportation to and from the mitigation sites and from ground-disturbing activities on these sites to create habitat. Table 3.7-25 shows discussions of the different resource categories and the potential for impacts from the off-site restoration activities.

Table 3.7-25 Potential Nonbiological Impacts of Compensatory Mitigation Implementation

Resource Type	Potential for Impacts
Transportation	No. During initial restoration of habitat areas, earthmoving equipment and other construction vehicles would be transported to the sites. These relatively few trips would not be anticipated to cause traffic congestion near or en route to and from the sites. After restoration, there would be intermittent transportation to and from the mitigation sites. These largely single-vehicle trips would be intermittent and are not anticipated to cause traffic congestion near or en route to and from the sites.

Resource Type	Potential for Impacts
Air Quality and Global Climate Change	Yes, for criteria pollutant emissions. Construction vehicle exhaust and vehicle trips during management activities would contribute to diesel particulate emissions. Earthmoving, grading, and vegetation removal activities on the mitigation sites would result in fugitive dust during construction. Habitat restoration and revegetation would be undertaken on off-site mitigation sites in rural areas, and potential receptors sensitive to localized air impacts are anticipated to be distant. The establishment and management of these mitigation sites do not involve any materials or activities that may subject receptors to objectionable odors. Vehicle trips and the use of mowers and other machinery associated with the establishment and management of the mitigation sites would contribute to greenhouse gas emissions. However, these activities would be short term during construction and intermittent afterward.
Noise and Vibration	No. Restoration activities may result in noise and vibration impacts from vehicles, heavy equipment, mowers, and other small machinery. These activities would occur in a limited capacity and for a short duration in comparison with the overall construction noise associated with the project as a whole. As these sites are located in a rural environment, sensitive receptors are generally distant; consequently, human receptors would not be exposed to the generation of noise levels in excess of established standards or local noise ordinances
Electromagnetic Fields and Electromagnetic Interference	No. No large electrical equipment would be installed or removed and no ongoing radio or electrical transmissions would be required at the mitigation sites. Therefore, no electromagnetic fields would be generated that could cause electromagnetic interference.
Public Utilities and Energy	No. No existing energy infrastructure would be affected or required for the mitigation sites. The removal of existing irrigation systems, removal of agricultural plantings, and removal of any existing structures on the mitigation sites would generate small quantities of solid waste. These quantities are expected to be relatively small in the context of the total solid waste generated for construction of the alternatives, and local landfills have adequate capacity to accept any waste materials that would be hauled from the sites. At mitigation sites where irrigation infrastructure is currently in place, the existing irrigation water supply may be temporarily used. Water supply uses may include regular watering of native plantings to facilitate vegetation establishment and growth. Once success criteria have been met, the irrigation system would be removed and the watering efforts would cease. During this period, water use is not expected to exceed current water use patterns required for the existing agricultural uses. After establishment, these sites would not require irrigation water; consequently, the elimination of irrigation would increase the amount of water available for downstream uses. No irrigation facility would be removed or added that would affect existing water supply for downstream water customers. Mitigation sites would not require construction or expansion of wastewater treatment facilities or stormwater drainage facilities.
Hydrology and Water Resources	No. Restoration activities at mitigation sites could result in channel/basin excavation, wetland and upland habitat enhancement and revegetation (hydroseed/plantings), channel enhancement and stabilization (installation of large woody debris, excavation of pools), and installation of erosion measures. Construction best management practices would be used to minimize or avoid discharge of sediment from construction activities to waterways. Activities at mitigation sites would not include actions that would deplete groundwater supplies or interfere with groundwater recharge, such as creating an increase in impervious surfaces. Temporary construction activities associated with mitigation measures would not alter drainage patterns to a degree that would result in flooding or exceed the capacity of stormwater drainage facilities.

Resource Type	Potential for Impacts
Geology, Soils, Seismicity, and Paleontological Resources	No. Restoration of the mitigation sites would not expose people or structures to potential impacts from the ruptures of an earthquake, strong seismic ground shaking, seismic-related ground failure, or landslides because no structures are proposed as part of the mitigation. Excavation and vegetation removal could result in soil erosion. However, erosion control measures would be implemented that would prevent impacts from soil erosion and landslides. No structures are proposed that could be affected by unstable soils, lateral spreading, subsidence, liquefaction, or collapse. Ground-disturbing activities associated with the restoration of mitigation sites could result in impacts on known and previously unknown paleontological deposits. Project features include effective measures to engage a paleontological resource specialist for direct monitoring during construction and provisions to halt construction if paleontological resources are found. These measures would avoid and reduce the potential loss of valuable paleontological resources.
Hazardous Materials and Wastes	No. The establishment and management of off-site mitigation lands, including agricultural infrastructure removal, operation of heavy equipment, and use of herbicides, could result in a temporary increase in the transportation, use, and storage of hazardous materials. Demolition of existing structures is unlikely; however, if needed, such activities may result in a temporary increase in waste disposal. However, structures likely to be removed would be small, such as agricultural infrastructure involving wood, wire, metal, piping, and concrete materials, and are not anticipated to contain large amounts of hazardous materials. Facilities and construction sites that use, store, generate, or dispose of hazardous materials or wastes and hazardous material/waste transporters are required through stringent regulations to maintain plans for warning, notification, evacuation, and site security. Routine transport, use, storage, and disposal of hazardous materials are governed by numerous laws, regulations, and ordinances, thereby reducing the risk of accidental spills or releases.
Safety and Security	No. These mitigation sites would not be open to the public and there would be no safety and security issues related to their establishment and management.
Socioeconomics and Communities	No. Use of these off-site mitigation sites would not divide an established community or displace housing or businesses. These sites do not presently contain public facilities that would require relocation and they would not affect the economy through changes in property tax or sales tax revenues. If these sites are presently in agricultural production, their removal from production may result in minor changes to the agricultural economy and job base.
Land Use and Development	No. These mitigation sites would not conflict with any applicable land use plans, policies, or regulations. As these sites are presently agricultural or range land, their protection from development to use for biological resource mitigation would not create new incompatible land uses.
Agricultural Farmland	Yes. The partial or complete conversion of these mitigation sites to biological habitat could result in the loss of existing farmland or ranchland, including designated Important Farmland. In the event that Important Farmland is converted for mitigating impacts on biological resources, the Authority would implement AG-MM#1: Conserve Important Farmland, to mitigate for the converted agricultural farmland. It is not anticipated that there would be any required changes to Williamson Act contracts because the preservation of the land through the use conservation easements and acquisition of the property would not threaten or violate the terms of most of the Williamson Act contracts.
Parks, Recreation, and Open Space	No. No impacts on parks and recreation would occur because these mitigation sites would not preclude the use of parks or recreation areas, acquire any current public open-space areas, create a barrier to the access of any park or recreation area, result in acquisition of a recreation resource, increase the use of existing neighborhood and regional parks, or result in the alteration of existing recreational facilities.

Resource Type	Potential for Impacts
Aesthetics and Visual Quality	No. No structures are needed or proposed for the mitigation sites and no lighting would be used. Therefore, none of the mitigation activities would block views or be sources of nighttime glare or light.
Cultural Resources	Yes, for archaeological resources, if such resources were demolished or altered. Ground-disturbing activities associated with the restoration of mitigation sites could result in impacts on known and previously unknown archaeological deposits. Such resources may be eligible for listing in the CRHR or the NRHP. The eligibility of historic architectural resources on these mitigation sites has not yet been evaluated and would take place prior to construction. Existing structures including agricultural outbuildings and irrigation infrastructure could be found to be eligible for listing the CRHR or the NRHP. Existing project features and legal requirements would prevent the destruction or unauthorized alteration of any such architectural resources.

CRHR = California Register of Historical Resources
NRHP = National Register of Historic Places

In conclusion, there are no new unique impacts associated with the establishment and management of compensatory mitigation lands that have not already been evaluated and addressed in other sections of this Final EIR/EIS.

BIO-MM#11: Implement Measures to Minimize Impacts during Off-Site Habitat Restoration, or Enhancement, or Creation on Mitigation Sites

Prior to ground-disturbing activities associated with habitat restoration, enhancement, and/or creation actions at a mitigation site, the Authority will conduct a site assessment of the work area to identify biological and aquatic resources, including plant communities, land cover types, and the distribution of special-status plants and wildlife.

Based on the results of the site assessment, the Authority will obtain any necessary regulatory authorizations prior to conducting habitat restoration, enhancement and/or creation activities, including authorization under the FESA or CESA, Cal. Fish and Game Code Section 1600 et seq., the CWA, and the Porter-Cologne Act.

Restoration, enhancement, and/or creation of aquatic resources may result in the permanent conversion of grassland to wetland or riparian habitat. While such activities will be beneficial for vernal pool, riparian, and aquatic-breeding species, they will result in a small but measurable loss of upland habitat for other species (e.g., foraging habitat for tricolored blackbird, non-breeding habitat for California tiger salamander and California red-legged frog). Permanent impacts on grassland habitat from aquatic resource restoration, enhancement, and creation will be mitigated at a minimum ratio of 1:1 (acres preserved, enhanced, or restored: acres affected).

BIO-MM#12: Provide Compensatory Mitigation for Impacts on Listed Plant Species

The Authority will provide compensatory mitigation for direct impacts on federally and state-listed plant species based on the number of acres of occupied plant habitat directly affected. Such mitigation will include the following measures:

- Compensatory mitigation will be provided at a 1:1 ratio to offset direct impacts on occupied federally listed plant species habitat, unless a higher ratio is required pursuant to regulatory authorizations issued under FESA.
- Compensatory mitigation will be provided at a 1:1 ratio to offset direct impacts on occupied state-listed plant species habitat, unless a higher ratio is required pursuant to regulatory authorizations issued under CESA.

Compensatory mitigation will be provided using one or more of the methods described in BIO-MM#10.

Impacts from Implementing Mitigation Measure BIO-MM#12

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#13: Implement Work Stoppage

In the event that any special-status wildlife species is found in a work area, the Project Biologist will have the authority to halt work to prevent the death or injury to the species. Any such work stoppage will be limited to the area necessary to protect the species and work may be resumed once the Project Biologist determines that the individuals of the species have moved out of harm's way or the Project Biologist has relocated them out of the work area in accordance with authorizations issued under FESA and CESA.

Any such work stoppages and the measures taken to facilitate the removal of the species, if any, will be documented in a memorandum prepared by the Project Biologist and submitted to the Authority within 2 business days of the work stoppage.

BIO-MM#14: Avoid Direct Impacts on Bay Checkerspot and Monarch Butterfly Host Plants

Prior to construction, the Project Biologist will survey for Bay checkerspot and monarch butterfly larval host plants—dwarf plantain and purple owl's-clover for Bay checkerspot and native milkweed species for monarch—within suitable habitat. If host plants are found, the Project Biologist will conduct surveys for adult butterflies during the peak of the flight/migration/breeding periods to determine presence/absence. If surveys are not possible due to the timing of the survey relative to the presence of the species, presence may be assumed. Where adult butterflies are present, or assumed to be present, construction personnel will avoid host plants outside permanent impact areas.

BIO-MM#15: Prepare and Implement Bay Checkerspot Butterfly Protection Plan

Prior to final design, the Authority will incorporate features to minimize impacts on Bay checkerspot butterfly dispersal consistent with regulatory authorizations issued under the FESA. Actions may include:

- Plant shrubs or trees along the east side of the viaduct, the predominant direction from which dispersing butterflies are likely to originate. Trees and shrubs will provide a more natural transition over the viaduct.
- Place lighting under the viaduct in strategic locations to minimize shadows.
- Create vegetated "stepping stones" to attract butterflies under the viaduct and along a path that is the shortest distance between the Coyote Ridge core population and the Tulare Hill sub-population.

If monitoring indicates that dispersal is affected by viaduct shadows, the Authority will develop a translocation project to facilitate Bay checkerspot butterfly dispersal between the core and sub-population. The project may include:

- Conservation of land near the alignment to improve survival conditions for dispersing butterflies.
- A monitoring and adaptive management process that will detail how the performance criteria of "no net change in dispersal" will be defined and maintained.

BIO-MM#16: Provide Compensatory Mitigation for Impacts on Bay Checkerspot Butterfly Habitat

The Authority, in accordance with authorizations issued under the FESA, will determine the compensatory mitigation required to offset impacts on habitat, including critical habitat, for Bay checkerspot butterfly. Compensatory mitigation could include one or more of the following:

- Purchase of credits from an agency-approved conservation bank
- Acquisition in fee title of USFWS-approved property

- Purchase or establishment of a conservation easement with an endowment for long-term management of the property-specific conservation values
- An in-lieu fee contribution determined through negotiation and consultation with the USFWS
- Contribution to SCVHA habitat protection, restoration, or management efforts

Mitigation for Bay checkerspot butterfly will first prioritize measures within the San Martin critical habitat unit and, to the extent feasible, that contribute to regional conservation efforts (i.e., habitat protection efforts underway by the SCVHA). The second priority will be to implement measures in another critical habitat unit. If mitigation within designated critical habitat is not feasible, the Authority will implement mitigation outside critical habitat that provides an equivalent contribution to Bay checkerspot butterfly recovery.

The compensatory mitigation areas and methods selected will include appropriate measures to guide management of habitats (e.g., grazing, weed control), monitor populations, and identify methods to establish or reestablish populations, if necessary.

- Habitat restoration and management will be needed on many Bay checkerspot habitat areas. Appropriate grazing management should verify that habitats are neither overgrazed nor overgrown. Weeding, biological control, mowing, herbicides, and fire should also be considered as possible tools to control nonnative plant species.
- Monitoring of populations will serve to identify, on an ongoing basis, populations that are in trouble and in need of recovery efforts, as well as populations that are healthy and suitable as sources of individuals for reintroduction efforts.

Several factors are important in deciding which habitat areas to protect: (1) habitat size and quality, including habitat diversity; (2) location in relation to other habitat patches and to core populations; (3) presence, current or historic, of Bay checkerspots; and (4) ease and cost of protection. Habitat protection should include buffer zones as necessary. Bay checkerspot habitat areas considered for mitigation can be ranked in approximate order of priority as follows:

- Core habitat areas

  a) Kirby (3,900 acres)
  b) Metcalf (1,100 acres)
  c) San Felipe (780 acres)
  d) Silver Creek Hills (1,000 acres)

- Potential core areas—Santa Teresa Hills (1,100 acres)
- Larger, good-quality habitat areas near core populations

  a) Tulare Hill (300 acres)
  b) North of Llagas Avenue (420 acres),
  c) West hills of Santa Clara Valley (74 acres)

- Stepping stones—Tulare Hill, Santa Teresa Hills, Redwood City
- Other current or historic localities or suitable habitat areas, generally larger than 1 hectare (2.5 acres), within the historic range of the butterfly, identified for their habitat value, function as dispersal corridors, proximity to other habitat, or other biological value.

The Authority will submit a memorandum to the USFWS to document compliance with this measure.

Impacts from Implementing Mitigation Measure BIO-MM#16

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#17: Conduct Pre-Construction Surveys for Vernal Pool Wildlife Species

Prior to any ground-disturbing activities, the Project Biologist will conduct an aquatic habitat assessment and survey for vernal pool wildlife species in seasonal wetlands and vernal pools that overlap with the work area or with occur within both the work area and the area extending 250 feet from the outer boundary of the work area where access is available, consistent with the USFWS *Survey Guidelines for the Listed Large Brachiopods* (USFWS 2015) vernal pool survey protocols. The Project Biologist will visit these areas after the first rain event of the season to determine whether seasonal wetlands and vernal pools have been inundated. A seasonal wetland/vernal pool will be considered to be inundated when it holds more than 3 cm of standing water 24 hours after a rain event. Approximately 2 weeks after the pools have been determined to be inundated, the Project Biologist will conduct surveys in appropriate seasonal wetland and vernal pool habitats. The Project Biologist will submit a report to the Authority within 30 days of completing the work.

BIO-MM#18: Implement Seasonal Vernal Pool Work Restriction

To the extent feasible, ground-disturbing activities will not occur within 250 feet of vernal pools or seasonal wetlands during the rainy season (October 15 to April 15). In the event ground-disturbing activities are to occur within the 250-foot buffer area during the rainy season, such activities should, to the extent feasible, be undertaken when the aquatic features are not inundated. For any work occurring within 250 feet of vernal pools during the rainy season, the contractor (under the direction of the Project Biologist) will install erosion control measures in those areas where construction activities need to be completed and ESA fencing between the work area and vernal pools.

BIO-MM#19: Implement and Monitor Vernal Pool Avoidance and Minimization Measures within Temporary Impact Areas

To the extent feasible, impacts on vernal pools in work areas outside of the permanent right-of-way will be avoided. The Project Biologist will install and maintain exclusionary fencing to prevent impacts on vernal pools from construction activities. When avoidance of impacts on vernal pools is not feasible, the construction activity will be scheduled to occur in the dry season, where feasible. Prior to the initiation of a ground-disturbing activity during the dry season, the Project Biologist will collect a representative sampling of soils from the affected vernal pools to obtain viable plant seeds and vernal pool branchiopod cysts. After collecting the soil, the Project Biologist may also put rinsed gravel in the vernal pools and cover with geotextile fabric to minimize damage to the soils and protect the pools' contours, as provided by regulatory authorizations issued under the FESA.

The soils containing seeds and cysts may later be returned to the affected pool after work has been completed or incorporated into other vernal pools, as provided by regulatory authorizations under the FESA.

BIO-MM#20: Provide Compensatory Mitigation for Impacts on Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp Habitat

The Authority will provide compensatory mitigation for direct and indirect impacts, including both temporary and permanent impacts, on vernal pool branchiopod habitat at a 1:1 ratio, unless a higher ratio is required by the FESA. Compensatory mitigation will be provided using one or more of the methods described in BIO-MM#10.

Impacts from Implementing Mitigation Measure BIO-MM#20

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#21: Implement Avoidance Measures for Elderberry Shrubs outside Permanent Impact Areas

To avoid direct impacts on elderberry shrubs potentially occupied by valley elderberry longhorn beetle that are inside the project footprint but outside permanent impact areas (and where feasible), a biologist with demonstrated experience identifying elderberry shrubs will survey areas modeled as potentially suitable riparian habitat within the project footprint for elderberry no less

than 30 days before ground disturbance or vegetation removal. The biologist will mark all elderberry shrubs with bright-colored flagging and record geospatial information using a handheld GPS or mobile device (i.e., smartphone or tablet). Elderberry shrubs outside permanent and temporary impact areas will be included on grading plans, and contractors will comply with the following avoidance and minimization measures from the USFWS' *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle* (USFWS 2017b):

- All areas to be avoided during construction activities will be fenced, flagged, or both as close to construction limits as feasible.
- Activities that may damage or kill an elderberry shrub (e.g., trenching, paving) may need an avoidance area of at least 20 feet from the drip line, depending on the type of activity.
- A qualified biologist will provide training for all contractors, work crews, and any on-site personnel on the status of the valley elderberry longhorn beetle, its host plant and habitat, the need to avoid damaging elderberry shrubs, and the possible penalties for noncompliance.
- A qualified biologist will monitor the work area at project-appropriate intervals to verify that all avoidance and minimization measures are implemented.
- To the extent feasible, all activities that could occur within 65 feet of an elderberry shrub will be conducted outside the flight season of the valley elderberry longhorn beetle (March–July).
- Trimming of elderberry shrubs will occur between November and February and will avoid the removal of any branches or stems that are 1 inch or more in diameter.
- Herbicides will not be used within the drip line of elderberry shrubs. All chemicals will be applied using a backpack sprayer or similar direct application method.
- Mechanical weed removal within the drip line of elderberry shrubs will be limited to the season when adults are not active (August–February) and will avoid damaging elderberry shrubs.

BIO-MM#22: Provide Compensatory Mitigation for Impacts on Valley Elderberry Longhorn Beetle Habitat

The Authority will provide compensatory mitigation for impacts on valley elderberry longhorn beetle habitat, including through transplantation and replacement of elderberry shrubs and maintenance of replacement shrubs, consistent with the USFWS' *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle* (USFWS 2017b), as follows:

- Suitable riparian habitat will be replaced at a minimum of 3:1 (acres of mitigation to acres of impact).
- Suitable nonriparian habitat will be replaced at a minimum of 1:1 (acres of mitigation to acres of impact).
- Individual elderberry shrubs in riparian areas will be replaced through a purchase of two credits at a USFWS-approved bank for each shrub that will be trimmed or removed regardless of the presence of exit holes.
- Individual elderberry shrubs in nonriparian areas will be replaced through a purchase of one credit at a USFWS-approved bank for each shrub that will be trimmed if exit holes have been found in any shrub in or within 165 feet of the work area.
- If an elderberry shrub is to be completely removed by the activity, the entire shrub will be transplanted to a USFWS-approved location in addition to the specified credit purchase.

For transplanted elderberry plants, a survival rate of at least 60 percent of the elderberry plants and 60 percent of the associated native plants must be maintained throughout the 10-year monitoring period. If survival rates drop below 60 percent during the monitoring period, failed plantings will be replaced and maintained until the 60 percent survival rate is achieved.

Impacts from Implementing Mitigation Measure BIO-MM#22

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#23: Conduct Surveys and Implement Avoidance Measures for Crotch Bumble Bee

Surveys for Crotch bumble bee habitat (as identified by species habitat suitability modeling) in the project footprint will be conducted by qualified biologists within 1 year prior to the start of construction. Surveys will be conducted during four evenly spaced sampling periods during the flight season (March through September) (Thorp et al. 1983). For each sampling event, the biologist(s) will survey suitable habitat using nonlethal netting methods for 1 person-hour per 3 acres of the highest quality habitat or until 150 bumble bees are sighted, whichever comes first. If initial sampling of a given habitat area indicates that the habitat is of low quality or nonexistent, no further sampling of that area will be required. General guidelines and best practices for bumble bee surveys will follow USFWS' *Survey Protocols for the Rusty Patched Bumble Bee* (*Bombus affinis*) (USFWS 2019), which are consistent with other bumble bee survey protocols used by The Xerces Society (Hatfield et al. 2017; Washington Department of Fish and Wildlife et al. 2019).

If surveys identify occupied Crotch bumble bee habitat within the project footprint, the project biologist will then conduct additional pre-construction surveys of such habitat for active bee nest colonies and associated floral resources (i.e., flowering vegetation on which bees from the colony are observed foraging) no more than 30 days prior to any ground disturbance between March and September. The purpose of this pre-construction survey will be to identify active nest colonies and associated floral resources outside of permanent impact areas that could be avoided by construction personnel. The project biologist will establish, monitor, and maintain no-work buffers around nest colonies and floral resources identified during surveys. The size and configuration of the no-work buffer will be based on best professional judgment of the project biologist. At a minimum, the buffer will provide at least 50 feet of clearance around nest entrances and maintain disturbance-free airspace between the nest and nearby floral resources. Construction activities will not occur within the no-work buffers until the colony is no longer active (i.e., no bees are seen flying in or out of the nest for three consecutive days indicating the colony has completed its nesting season and the next season's queens have dispersed from the colony).

BIO-MM#24: Provide Compensatory Mitigation for Impacts on Crotch Bumble Bee

The Authority will provide compensatory mitigation for impacts on occupied habitat for Crotch bumble bee. Impacts on occupied habitat (confirmed through surveys as described in BIO-MM#23) will be compensated for at a ratio of 3:1, unless a higher ratio is required pursuant to an authorization issued under CESA, through the purchase of CDFW-approved bank credits or through preservation of habitat in perpetuity, including suitable habitat currently preserved by the Authority.

BIO-MM#25: Prepare Plan for Dewatering and Water Diversions

Prior to initiating any construction activity that occurs within open or flowing water, or streamside activities, the Authority will prepare a dewatering plan, which will be subject to the review and approval by the applicable regulatory agencies. The plan will incorporate measures to minimize turbidity and siltation. The Project Biologist will monitor the dewatering and/or water diversion sites, including collection of water quality data, as applicable. Prior to the dewatering or diverting of water from a site, the Project Biologist will conduct pre-activity surveys to determine the presence or absence of special-status species within the affected waterbody. In the event that special-status species are detected during pre-activity surveys, the Project Biologist will relocate the species (unless the species is fully protected under state law), consistent with any regulatory authorizations applicable to the species.

BIO-MM#26: Prepare and Implement a Fish Rescue Plan

If temporary stream dewatering is required, the Authority or a contractor on behalf of the Authority will develop a fish rescue plan. Fish rescue operations will occur at any in-water construction site that occurs in modeled steelhead habitat or habitat identified by project biologists during pre-construction surveys where dewatering and resulting isolation of fish may occur. The fish rescue plan will include detailed procedures for fish rescue and salvage to minimize the number of

individuals of listed fish species subject to stranding during dewatering. The plan will identify the appropriate procedures for removing fish from construction zones and preventing fish from reentering construction zones prior to dewatering and other construction activities.

All fish rescue and salvage operations will be conducted under the guidance of a qualified fish biologist (as defined by NMFS) and in accordance with required permits. At each crossing of modeled steelhead habitat, the fish rescue plan will identify the appropriate procedures for excluding fish from the construction zone and for removing fish from areas subject to dewatering. The primary procedure will be to block off the construction area and use seines (nets) or dip nets to collect and remove fish, although electrofishing techniques may also be authorized under certain conditions. It is critical that fish rescue and salvage operations begin as soon as possible and be completed within 48 hours after isolation of a construction area to minimize potential predation and adverse water quality impacts (high water temperature, low dissolved oxygen) associated with confinement. Block nets, sandbags, or other temporary exclusion methods could be used to exclude fish or isolate the construction area prior to the fish removal process. The appropriate fish exclusion or collection method will be determined by a qualified fish biologist, in consultation with a designated NMFS biologist, based on site-specific conditions and construction methods. Capture, release, and relocation measures will be consistent with the general guidelines and procedures set forth in Part IX of the most recent edition of the California Salmonid Stream Habitat Restoration Manual (CDFG 2004) to minimize impacts on listed species of fish and their habitat. A draft plan will be submitted to NMFS at least 48 hours prior to fish rescue and relocation.

BIO-MM#27a: Implement General Protection Measures for Fish

The Authority or a contractor on behalf of the Authority will implement several general protection measures to protect and minimize effects on steelhead and their habitat during construction. The following measures will be implemented during design:

- Design temporary night lighting of overwater structures (if needed) such that illumination of the surrounding water is avoided.
- Locate temporary construction areas (e.g., staging, storage, parking, and stockpiling areas) outside of channels and riparian areas wherever feasible.
- Minimize, to the extent feasible, the placement of footings and columns within the active channel (between top of bank) of steelhead critical habitat.
- Use low-impact development methods for stormwater treatment, including locations that could otherwise contribute polluted stormwater to streams that provide habitat for fish listed under the ESA. Such measures may consist of pervious hardscapes (for pollutant-generating areas such as parking lots), bioswales, infiltration basins, rain gardens, and other design measures that will capture and treat polluted runoff before it reaches sensitive natural waterways.
- The following bank stabilization and erosion control measures will be implemented during design and construction to minimize habitat disturbance:
    - Temporarily fence areas of natural riparian vegetation that can be avoided with high-visibility ESA fencing to enforce avoidance.
    - Use “soft” approaches to bank erosion control to the extent possible (e.g., vegetative plantings, placement of large woody debris). Avoid hard bank protection methods (e.g., revetment) wherever feasible.
    - Avoid the use of wood treated with creosote or copper-based chemicals in bank stabilization efforts.
    - Use quarry stone, cobblestone, or their equivalent for erosion control along rivers and streams, complemented with native riparian plantings or other natural stabilization alternatives that will maintain a natural riparian corridor, where feasible. Cobble size

types and spacing of riparian plantings and other details on riparian restoration activities will be provided in the restoration and revegetation plan described in BIO-MM#1.

- Revegetate temporarily disturbed areas with native plants to resemble the existing vegetation.

BIO-MM#27b: Work Windows for Fish

Near-water and in-water work will be conducted within specified work windows based on date, channel inundation, and water temperature. Work windows will include the general time periods when effects on migrating juvenile and adult steelhead will be minimal. Additionally, in-water work will be allowed when salmonid use is temperature limited (defined as 1 week of average water temperature of 75°F or more); and work will be allowed in the channel and on the floodplain when channels are dry or ponded.

- During work windows, work will only be allowed in the channel and on the floodplain from 1 hour after sunrise until 1 hour before sunset.
- Near-water or over-water work is defined as construction activities occurring within the floodplain but not in the wetted channel (e.g., located between the wetted channel and the landside toe of the bordering levees or over the wetted channel). In-water work is defined as work within the wetted channel.
- The near-water construction work window will be April 30 through December 1. For in-water work, the construction work window will be June 15 through October 15. These periods may be extended subject to receipt of written authorization from NMFS that incidental take limits will not be exceeded.
- If channels are dry or ponded (i.e., lack continuous flow), or water temperatures average 75°F or more for 7 consecutive days, in-water and near-water work can proceed outside the work windows stated above. NMFS will be consulted to verify work can proceed if these conditions are present during construction.

BIO-MM#27c: Prepare and Implement an Underwater Sound Control Plan

The Authority or a contractor on behalf of the Authority will develop an underwater sound control plan to avoid and minimize potential adverse impacts from in-water pile-driving activities on federally listed salmonid species. Effects will be minimized by limiting the period during which impact pile driving may occur and by limiting or abating underwater noise generated during impact pile driving. The underwater sound control plan will be provided to NMFS for review and approval prior to in-water impact pile driving on steelhead in the context of the following underwater noise thresholds established for disturbance and injury of fish:

- Injury threshold for fish of all sizes includes a peak sound pressure level of 206 decibels relative to 1 micropascal.
- Injury threshold for fish less than 2 grams is 183 decibels relative to 1 micropascal cumulative sound exposure level and 187 decibels relative to 1 micropascal cumulative sound exposure level for fish greater than or equal to 2 grams.
- Disturbance threshold for fish of all sizes is 150 decibels root mean square relative to 1 micropascal.

The underwater sound control plan will restrict in-water work to the in-water work window specified in permits issued by the fish and wildlife agencies (including NMFS) and to daylight hours between 1 hour after sunrise and 1 hour before sunset with a 12-hour break between pile driving sessions. The underwater noise generated by impact pile driving will be abated using the best available and practicable technologies. Examples of such technologies include, but are not limited to, the use of cast-in-drilled-hole rather than driven piles; use of vibratory rather than impact pile driving equipment; using an impact pile driver to proof piles initially placed with a vibratory pile driver; noise attenuation using pile caps (e.g., wood or Micarta), bubble curtains, air-filled fabric barriers, or isolation piles; and installation of piling-specific cofferdams. Specific techniques to be used will be selected based on site conditions.

In addition to primarily using vibratory pile driving methods and establishing protocols for attenuating underwater noise levels produced during in-water construction activities, the Authority will develop and implement operational protocols for when impact pile driving is necessary. These operational protocols will be used to minimize the effects of impact pile driving on steelhead. These protocols may include, but not be limited to, the following: monitoring the in-water work area for fish that may be showing signs of distress or injury as a result of pile-driving activities and stopping work when distressed or injured fish are observed; initiating impact pile driving with a "soft-start," such that pile strikes are initiated at reduced impact and increase to full impact over several strikes to provide fish an opportunity to move out of the area; restricting impact pile-driving activities to specific times of the day and for a specific duration to be determined through coordination with the fish and wildlife agencies; and, when more than one pile-driving rig is employed, initiating pile-driving activities in a way that provides an escape route and avoids "trapping" fish between pile drivers in waters exposed to underwater noise levels that could potentially cause injury.

BIO-MM#28: Provide Compensatory Mitigation for Permanent Impacts on Steelhead Habitat and Essential Fish Habitat for Pacific Coast Salmon

The Authority will provide compensatory mitigation for permanent impacts on habitat for CCC and SCCC steelhead and designated freshwater EFH for Pacific Coast salmon that is commensurate with the type (spawning, rearing, migratory, or critical habitat) and amount of habitat lost as follows:

- Spawning aquatic and riparian habitat within critical habitat will be protected and restored or protected and enhanced at a minimum of 3:1 (protected:affected) unless different ratios are specified in authorizations issued under the FESA
- All rearing and migratory aquatic and riparian habitat within critical habitat will be protected and restored or protected and enhanced at a minimum of 2:1 (protected:affected) or as specified in authorizations issued under the FESA
- All other rearing and migratory aquatic and riparian habitat outside of critical habitat will be protected and restored or protected and enhanced at a minimum of 1:1 (protected:affected) or as specified in authorizations issued under the FESA

Unless agreed upon in coordination with NMFS, compensation will occur within the same distinct population segment domain as the impact was incurred. Where feasible, on-site, in-kind mitigation will be prioritized. Off-site mitigation will prioritize actions recommended in local or regional conservation plans where there is coordination and approval by NMFS. Other options include the purchase of riparian and aquatic habitat credits at an NMFS-approved anadromous fish conservation bank, or through another NMFS-approved conservation option, for the areal extent of riparian and suitable aquatic habitat affected by the action. In the event the Authority chooses not to utilize existing mitigation banks, it will propose other approaches to the applicable regulatory agencies for consideration. Any such approaches will take into account the following:

- Habitat complexity such as floodplain backwaters (designed to limit stranding); refugia habitat such as deep pools, root wads, undercut banks or boulders; feeding and spawning habitat (riffles and runs); and connectivity with migratory habitat
- Riparian habitat conditions that are consistent with the existing flow regime and maintain and improve habitat characteristics (e.g., shade, formation and maintenance of refugia)
- Local and regional conservation goals
- Long-term access for monitoring and maintenance
- Upstream and downstream conditions

Conservation options developed to offset impacts on steelhead habitat and EFH will be considered in the development of the HMP (BIO-MM#10), Restoration and Revegetation Plan (BIO-MM#1), and Flood Protection Plan (HYD-IAMF#2).

Impacts from Implementing Mitigation Measure BIO-MM#28

As addressed in the discussion of BIO-MM#9, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#10 would be implemented to minimize any adverse impacts.

BIO-MM#29: Conduct Pre-Construction Surveys for California Tiger Salamander

Prior to any ground-disturbing activity scheduled to occur during the dry season (June 1–October 15), the Project Biologist will conduct a pre-construction survey of suitable upland habitat within the work area and extending out 100 feet from the boundary of the work area, where access is available, to determine whether California tiger salamanders are present. Such surveys will be conducted no earlier than 30 days prior to ground-disturbing activities in the work area. The Project Biologist may employ the use of conservation dogs (scent dogs) to augment focused species surveys using methods described in Wasser et al. (2004), Smith et al. (2006), and/ or Filazzola et al. (2017). The Project Biologist will coordinate with USFWS and CDFW before using conservation dogs.

In the event that ground-disturbing activities are scheduled to occur during the rainy season (October 15–June 1), in addition to upland surveys, the Project Biologist will survey potential breeding habitat in the work area for the presence of California tiger salamanders using methods from the *Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander* (CDFG and USFWS 2003) or other more recent guidelines, if available.

BIO-MM#30: Implement Avoidance and Minimization Measures for California Tiger Salamander

Prior to any ground-disturbing activity, the contractor, under the direction of the Project Biologist will install WEF along the boundary of the work area containing California tiger salamander suitable habitat or will implement similar measures as otherwise required pursuant to regulatory authorizations issued under the FESA or CESA. WEF must be trenched into the soil at least 4 inches in depth, with the soil compacted against both sides of the fence for its entire length to prevent tiger salamanders from passing under the fence, and must have intermittent exit points. During the dry season (June 1–October 15), the Project Biologist will inspect the WEF at least twice weekly on nonconsecutive days and on a daily basis between October 15 and June 1 or following any rain event. WEF will be installed with turnarounds at access points to direct California tiger salamander away from gaps in the fencing.

To the extent feasible, construction activities will not be conducted within 250 feet of areas identified as occupied California tiger salamander breeding habitat during the rainy season (October 15–June 1). However, construction activities may begin within such areas after April 15 if the breeding habitat is no longer inundated.

BIO-MM#31: Provide Compensatory Mitigation for Impacts on California Tiger Salamander Habitat

The Authority will provide compensatory mitigation to offset the loss of modeled California tiger salamander habitat. Compensatory mitigation will be provided for impacts on habitat occupied or presumed occupied by California tiger salamander at a ratio of 3:1, unless higher ratios are required through regulatory authorizations issued under the FESA or CESA. Compensatory mitigation will be provided using one or more of the methods described in BIO-MM#10.

Impacts from Implementing Mitigation Measure BIO-MM#31

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#32: Conduct Pre-Construction Surveys and Implement Avoidance and Minimization Measures for California Red-Legged Frog

Prior to any ground-disturbing activity scheduled to occur during the dry season (June 1–October 15), the Project Biologist will conduct a pre-construction survey of modeled suitable potential breeding habitat within the work area and extending out 100 feet from the boundary of the work

area, where access is available, to determine whether California red-legged frogs are present using methods from the *Revised Guidance on Site Assessments and Field Surveys for The California Red-legged Frog* (USFWS 2005), or other more recent guidelines, if available. Such surveys will be conducted no earlier than 30 days prior to ground-disturbing activities in the work area. Appropriate avoidance and minimization measures, including moving individuals to nearby ponds, or other appropriate measures, will be implemented based on authorizations issued under the FESA.

BIO-MM#33: Provide Compensatory Mitigation for Impacts on California Red-Legged Frog Habitat

The Authority, in accordance with authorizations issued under the FESA, will compensate for impacts on habitat, including critical habitat, for California red-legged frog. Compensatory mitigation could include one or more of the following:

- Purchase of credits from an agency-approved conservation bank
- Acquisition in fee title of USFWS-approved property
- Purchase or establishment of a conservation easement with an endowment for long-term management of the property-specific conservation values
- An in-lieu fee contribution determined through negotiation and consultation with the USFWS

Compensatory mitigation for red-legged frog will prioritize lands that will contribute to the recovery of the species and, to the extent feasible, to regional conservation efforts. The recovery plan for the California red-legged frog (USFWS 2002) describes tasks that will contribute to the recovery of the California red-legged frog. To the extent feasible, the compensatory mitigation for California red-legged frog will incorporate one or more of the following conservation needs identified by the recovery plan for the core recovery areas:

- East San Francisco Bay Core Recovery Area: protect existing populations; control nonnative predators; study effects of grazing in riparian corridors, ponds, and uplands (e.g., on East Bay Regional Park District lands); reduce impacts associated with livestock grazing; protect habitat connectivity; minimize impacts of recreation and off-road vehicle use (e.g., Corral Hollow watershed); avoid and reduce impacts of urbanization; protect habitat buffers from nearby urbanization (Recovery Task 1.16)
- Santa Clara Valley Core Recovery Area: protect existing populations and control nonnative predators (Recovery Task 1.17)

The first priority will be to implement compensatory mitigation within the Wilson Peak Critical Habitat Unit. The second priority will be to implement compensatory mitigation in another designated critical habitat unit. If mitigation within designated critical habitat is not feasible, the Authority will implement compensatory mitigation outside critical habitat that provides an equivalent contribution to California red-legged frog recovery. Compensatory mitigation will be provided for impacts on California red-legged frog breeding and refugia/foraging habitat at a ratio of 3:1 and 2:1, respectively.

Impacts from Implementing Mitigation Measure BIO-MM#33

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#34: Conduct Pre-Construction Surveys and Implement Avoidance and Minimization Measures for Foothill Yellow-Legged Frog

Prior to any ground-disturbing activity scheduled to occur during the dry season (June 1–October 15), the Project Biologist will survey potential breeding habitat (as identified by species modeling) in the project footprint for the presence of foothill yellow-legged frogs using methods outlined in the *Considerations for Conserving the Foothill Yellow-Legged Frog* (CDFW 2018d), the *Visual Encounter Survey Protocol for* Rana boylii *in Lotic Environments* (Peek et al. 2017), or other more recent guidelines, if available. Surveys will be conducted no more than 30 days before the start of

ground-disturbing activities and will be spatially phased to precede construction activities. Appropriate avoidance and minimization measures, including moving individuals to nearby ponds or other appropriate measures, will be implemented with authorizations issued under the CESA.

BIO-MM#35: Provide Compensatory Mitigation for Impacts on Foothill Yellow-Legged Frog Habitat

The Authority, in keeping with the state incidental take permit, will provide compensatory mitigation for impacts on habitat for foothill yellow-legged frog. Impacts on occupied or presumed occupied aquatic habitat will be compensated for at a ratio of 3:1 for primary breeding and foraging habitat through the purchase of CDFW-approved bank credits or through preservation of occupied habitat in perpetuity.

Impacts from Implementing Mitigation Measure BIO-MM#35

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#36: Conduct Pre-Construction Surveys for Special-Status Reptiles and Amphibians

Prior to any ground-disturbing activities, the Project Biologist will conduct pre-construction surveys in suitable habitat to determine the presence or absence of special-status reptile and amphibian species within the work area. Surveys will be conducted no more than 30 days before the start of ground-disturbing activities in a work area. The results of the pre-construction survey will be used to guide the placement of ESAs or conduct species relocation.

BIO-MM#37: Implement Avoidance and Minimization Measures for Special-Status Reptiles and Amphibians

The Project Biologist will monitor all initial ground-disturbing activities that occur within suitable habitat for special-status reptiles and amphibians, and will conduct clearance surveys of suitable habitat in the work area on a daily basis. If a special-status reptile or amphibian is observed, the Project Biologist will identify actions, to the extent feasible, sufficient to avoid impacts on the species and to allow it to leave the area of its own volition. Such actions may include establishing a temporary ESA in the area where a special-status reptile or amphibian has been observed and delineating a 50-foot no-work buffer around the ESA. In circumstances where a no-work buffer is not feasible the Project Biologist will relocate any of the species observed from the work area. For federally or state-listed species, relocations will be undertaken in accordance with regulatory authorizations issued under the FESA or CESA.

BIO-MM#38: Conduct Surveys for Blunt-Nosed Leopard Lizard

In accordance with authorizations issued under the FESA, a USFWS-approved biologist will conduct a habitat assessment of the project footprint within 1 year prior to the start of construction to identify all habitat suitable for blunt-nosed leopard lizard within the project footprint. Within 1 year of any ground-disturbing activity, the Project Biologist will conduct surveys for the blunt-nosed leopard lizard in suitable habitats (e.g., areas containing burrows) within the project footprint. These surveys will be conducted in accordance with the *Approved Survey Methodology for the Blunt-Nosed Leopard Lizard* (CDFW 2019), or other more recent guidelines, if available. The biologist(s) will also document burrows likely used by a lizard or with egg clutches, where feasible.

BIO-MM#39: Implement Avoidance Measures for Blunt-Nosed Leopard Lizard

For work areas where surveys confirm that blunt-nosed leopard lizards are absent, the Project Biologist may install WEF along the perimeter of the work area to prevent individual animals from entering the work area. The WEF will be monitored daily and maintained.

During the non-active season for blunt-nosed leopard lizards (October 16–April 14), to the extent feasible, ground-disturbing activities will not occur in areas where blunt-nosed leopard lizards or sign of the species have been observed and that contain burrows suitable for blunt-nosed leopard lizards. If ground-disturbing activities are scheduled during the non-active season, suitable burrows identified during the surveys will be avoided through establishment of 50-foot no-work

buffers. The Project Biologist may reduce the size of the no-work buffers if information indicates that the extent of the underground portion of burrows is less than 50 feet.

During the active season when blunt-nosed leopard lizards are moving aboveground (April 15–October 15), the following measures will be implemented in areas where blunt-nosed leopard lizards or signs of blunt-nosed leopard lizards have been observed:

- **Establishment of no-work buffers**—The Project Biologist will establish, monitor, and maintain 50-foot no-work buffers around burrows and egg clutch sites identified during surveys. The 50-foot no-work buffers will be established around burrows in a manner that allows for a connection between the burrow site and the suitable natural habitat adjacent to the construction footprint so that blunt-nosed leopard lizards or hatchlings may leave the area after eggs have hatched. Construction activities will not occur within the 50-foot no-work buffers until such time as the eggs have hatched and blunt-nosed leopard lizards have left the area.
- **Fencing of work areas**—Prior to installing WEF, the Project Biologist will confirm that no blunt-nosed leopard lizards are present within a work area by conducting focused blunt-nosed leopard lizard observational surveys for 12 days over the course of a 30- to 60-day period. At least one survey session will occur over 4 consecutive days. These observational surveys may be paired with scent detection dog surveys for blunt-nosed leopard lizard scat.

Within 3 days of completing these surveys with negative results, WEF will be installed in a configuration that accounts for burrow locations and enables blunt-nosed leopard lizards to leave the work area. The following day, the Project Biologist will conduct an observational survey. If no blunt-nosed leopard lizards are observed, the Project Biologist will install additional WEF to further enclose the work area. This work area will be monitored daily while the WEF is in place.

If blunt-nosed leopard lizards are observed prior to installing the last of the WEF, the Project Biologist will continue observational surveys until the lizard is observed leaving the work area or until 30 days elapse with no blunt-nosed leopard lizard observations within the work area. The Project Biologist may use conservation dogs to assist with this determination.

BIO-MM#40: Provide Compensatory Mitigation for Impacts on Blunt-Nosed Leopard Lizard Habitat

The Authority will provide compensatory mitigation to offset the permanent and temporary loss of potentially suitable habitat for the blunt-nosed leopard lizard. Mitigation will be provided at a ratio of 1:1 unless a higher ratio is required by authorizations issued under the FESA. Compensatory mitigation will be provided using one or more of the methods described in BIO-MM#10.

Impacts from Implementing Mitigation Measure BIO-MM#40

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#41: Conduct Pre-Construction Surveys and Implement Avoidance and Minimization Measures for Giant Garter Snake

Prior to any ground-disturbing activity that occurs within 200 feet of suitable giant garter snake aquatic habitat, the Project Biologist will conduct a pre-construction survey for giant garter snake no earlier than 24 hours before the commencement of the activity. The Project Biologist will remain on-site for the duration of the ground-disturbing activity. If a giant garter snake is encountered during construction, the Project Biologist will direct that work that has the potential to injure the snake be stopped until it is determined that work can continue without potential harm to the snake, or the snake moves out of the immediate work area on its own volition. Pre-construction surveys in work areas will be repeated whenever construction activity lapses for 2 weeks or more.

To the extent feasible, WEF will be installed along the upper bank of suitable aquatic habitat located within 200 feet of the boundary of the work area (provided access to such areas is available) or at the boundary of the work area to prevent snakes from moving into upland areas within the work area. The biological monitor will regularly inspect fencing. In addition, the

contractor will maintain all construction equipment to prevent leaks of fuels, lubricants, or other fluids and will conduct service and refueling procedures in uplands at least 100 feet away from wetlands or waterways.

To the extent feasible, construction activities within 200 feet of giant garter snake habitat will be conducted between May 1 and October 1, the active period for this species. Conducting construction activities during this period reduces the likelihood of mortality because snakes are expected to actively move and avoid danger. If dewatering of giant garter snake habitat is necessary, any dewatered habitat must remain dry for at least 15 consecutive days after April 15 and prior to excavating or filling of the dewatered habitat.

BIO-MM#42: Provide Compensatory Mitigation for Impacts on Giant Garter Snake Habitat

The Authority will provide compensatory mitigation, in accordance with authorizations issued under the FESA and CESA, for direct and indirect impacts including both temporary and permanent impacts on giant garter snake habitat. Compensatory mitigation will be provided at a minimum ratio of 1:1 for potentially suitable aquatic and upland habitat. Compensatory mitigation will be provided using one or more of the methods described in BIO-MM#10.

Impacts from Implementing Mitigation Measure BIO-MM#42

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#43: Conduct Pre-Construction Surveys and Delineate Active Nest Buffers for Breeding Birds

No more than 10 days prior to any ground-disturbing activity, including vegetation removal, scheduled to occur during the bird breeding season (February 1 to September 1), the Project Biologist will conduct visual pre-construction surveys within the work area for nesting birds and active nests (nests with eggs or young) of non-raptor species protected under the MBTA and/or the Cal. Fish and Game Code.

In the event that active bird nests are observed during the pre-construction survey, the Project Biologist will delineate no-work buffers and monitor the nests. No-work buffers will be set at a distance of 75 feet, unless a larger buffer is required pursuant to regulatory authorizations issued under the FESA or CESA, or if required by the Project Biologist to ensure the nest is not disturbed. No-work buffers will be maintained until nestlings have fledged and are no longer reliant on the nest or parental care for survival or the Project Biologist determines that the nest has been abandoned. In circumstances where it is not feasible to maintain the standard no-work buffer, the no-work buffer may be reduced, provided that the Project Biologist monitors the active nest during the construction activity to ensure that the nesting birds do not become agitated. Additional measures that may be used when no-work buffers are reduced include visual screens and noise barriers.

BIO-MM#44: Implement Avoidance and Minimization Measures for Mountain Plover and Sandhill Crane

The Authority will implement the following measures to avoid or minimize disturbance of flocks of wintering mountain plovers and sandhill cranes potentially occurring in the San Joaquin Valley Subsection:

- To avoid disturbance of wintering mountain plovers and sandhill cranes in the San Joaquin Valley Subsection, no construction activities involving heavy equipment or loud noise (e.g., pile driving) will be permitted within 250 feet of modeled habitat for mountain plover or within 0.75 mile of sandhill crane roost sites from October 1 to March 15, when large concentrations of both species are most likely to be present.
- Alternatively, the Authority or its contractor may conduct surveys for and avoid mountain plover wintering sites and sandhill crane roost sites prior to construction activities in or adjacent to modeled habitat between January and March 15 (no work could occur from October to December to allow surveys to be conducted). A minimum of four surveys will be conducted from October 1 to December 31 by a qualified biologist (or team of biologists)

experienced with observing both species (preferably in the regional RSA) within 0.75 mile of the portion of the project footprint where construction will occur. The Authority or its contractor may also identify mountain plover wintering sites and sandhill crane roost sites to be avoided by contacting local birders or biologists familiar with mountain plover and sandhill crane habitat use within 0.75 mile of the project footprint.

- Biologists will collect geospatial data on mountain plover (flocks of 30 birds or more) and sandhill crane (roost sites) observations in the field using handheld tablets, smartphones, or GPS units that enable drawing of points and multipoint polygons. After surveys are completed, all observations will be digitized into a single file and shared with the Authority and contractor.
- Contractors will avoid disturbance of mountain plovers by siting all activities between January 1 and March 15 more than 250 feet from observed mountain plover wintering sites.
- Contractors will avoid disturbance of observed sandhill crane roost sites by not conducting any nighttime (1 hour before sunset to 1 hour after sunrise) work within 0.75 mile of observed roost sites between January 1 and March 15.

BIO-MM#45: Conduct Surveys for Burrowing Owls

No more than 30 days but no less than 14 days prior to any ground-disturbing activity in burrowing owl habitat, the Project Biologist will conduct pre-construction surveys for burrowing owl within suitable habitat located in the work area and/or extending 250 feet from the boundary of the work area, where access is available. Surveys will be conducted in accordance with the SCVHP's condition of approval for covered activities in burrowing owl habitat (County of Santa Clara et al. 2012: page 6-62). This methodology is consistent with the CDFW *Staff Report on Burrowing Owl Mitigation* (CDFG 2012), but it may be updated based on future changes by the SCVHA.

BIO-MM#46: Implement Avoidance and Minimization Measures for Burrowing Owl

Occupied burrowing owl burrows found during pre-construction surveys will be avoided in accordance with the SCVHP's condition of approval for covered activities in burrowing owl habitat (County of Santa Clara et al. 2012: page 6-62). To the extent feasible, the Project Biologist will establish 250-foot no-work buffers around occupied burrowing owl burrows in the work area. An occupied burrow is defined as any burrow at which (1) an adult owl is observed on two or more pre-construction surveys, or (2) a pair of adult owls is observed on one or more pre-construction survey. Construction may proceed outside the 250-foot nondisturbance zone. Construction may proceed inside the 250-foot nondisturbance no-work buffer zone during the breeding season if the season-specific criteria (nesting season: February 1–August 31; non-nesting season: September 1–January 31) described in the SCVHP are met.

BIO-MM#47: Provide Compensatory Mitigation for Loss of Active Burrowing Owl Burrows and Habitat

To compensate for permanent impacts on occupied burrowing owl breeding habitat, the Authority will provide compensatory mitigation at a minimum 1:1 ratio for occupied breeding and foraging habitat. Lands proposed as compensatory mitigation will meet one of the following criteria:

- Support at least two breeding adult owls for every breeding adult owl displaced by construction of the project
- Support at least 1 acre of burrowing owl breeding habitat for every acre of habitat affected (i.e., 1:1 mitigation ratio). For the purposes of this measure, burrowing owl breeding habitat is defined as any land cover type with all of the following attributes:
  - Open terrain with well-drained soils
  - Short, sparse vegetation with few shrubs and no trees
  - Underground burrows or burrow surrogates (e.g., debris piles, culverts, pipes) for nesting and shelter from predators or weather. Burrows in earthen levees, berms, or canal banks

within or along the margins of agricultural fields can be counted as compensatory breeding habitat as long as adjacent fields or pastures are suitable for foraging.

– Abundant and accessible prey (arthropods, small rodents, amphibians, lizards)

Impacts from Implementing Mitigation Measure BIO-MM#47

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#48: Conduct Pre-Construction Surveys for Eagles

At least 1 year prior to the start of any ground-disturbing activities and construction, the Project Biologists will conduct nesting season surveys for eagles. Surveys for bald and golden eagle nests will be conducted within 4 miles of any construction areas supporting suitable nesting habitat and important eagle roost sites and foraging areas. Surveys will be conducted in accordance with the USFWS *Interim Golden Eagle Inventory and Monitoring Protocols* (Pagel et al. 2010), CDFW's *Bald Eagle Breeding Survey Instructions* (CDFW 2017), or current guidance. A nesting territory or inventoried habitat will be considered unoccupied by golden eagles only after completing at least two full surveys in a single breeding season. Prior to initial construction activities, the Project Biologist will conduct a pre-construction sweep of the project site for golden eagle use.

BIO-MM#49: Implement Avoidance Measures for Active Eagle Nests

Prior to the start of any ground-disturbing activity, if an occupied nest (as defined by Pagel et al. 2010) is detected within 4 miles of the work areas, the Authority will implement a 1-mile line-of-sight and 0.5-mile no-line-of-sight no-work buffer during the breeding season (January 1 through August 31) so that construction activities do not result in injury or disturbance to eagles. The no-work buffer will be maintained throughout the breeding season or until the young have fledged and are no longer dependent on the nest or parental care that includes nest use for survival.

Buffers around occupied nests may be reduced if the Project Biologist determines that smaller buffers will be sufficient to avoid impacts on nesting eagles. Factors to be considered for determining buffer size will include the presence of natural buffers provided by vegetation or topography, nest height, locations of foraging territory, and baseline levels of noise and human activity. Buffers will be maintained and nests monitored until the Project Biologist has determined that young have fledged and are no longer reliant on the nest or parental care that includes nest use for survival.

Eagle nest exclusion zones may be removed if monitoring reveals the nest not to be in use as determined by the Project Biologist. An in-use eagle nest is one that is "a bald or golden eagle nest characterized by the presence of one or more eggs, dependent young, or adult eagles on the nest in the past ten days during the breeding season" (USFWS 2016d). Monitoring to demonstrate whether or not eagle nests are in use will follow observational procedures described by Pagel et al. (2010).

In bald and golden eagle nesting territories, the Project Biologist will examine debris piles and determine if there is a potential to attract prey species. If the Project Biologist determines debris piles may attract prey species and pose a danger to eagles, the debris piles will be removed or moved.

BIO-MM#50: Provide Compensatory Mitigation for Loss of Eagle Nests

If pre-construction surveys identify in-use or alternate eagle nests in the permanent impact area, the Authority, in consultation with the USFWS, will develop a nest relocation or replacement plan for the affected nest(s). The plan will describe why there is no practicable alternative to nest removal while enabling project construction. Any relocation or replacement of eagle nests will be in accordance with the BGEPA and subject to the following minimum requirements:

- The nest will be relocated, or a suitable nest will be provided, within the same nesting territory to provide a viable nesting option for the affected eagle pair.

- Post-construction monitoring to confirm continued nesting within the affected nesting territory will be conducted for a minimum of 3 years using observation procedures described by Pagel et al. (2010).

BIO-MM#51: Implement Avoidance Measures for California Condor

During any ground-disturbing activities within the range of the California condor, as delineated in the USFWS database, the Authority will implement the following avoidance measures:

- The Project Biologist will be present for construction activities occurring within 2 miles of known California condor roosting sites.
- If USFWS informs the Authority or if the Authority is otherwise made aware that California condors are roosting within 0.5 mile of a work area, no construction activity will occur during the period between 1 hour before sunset and 1 hour after sunrise.
- All construction materials located within work areas, including items that could pose a risk of entanglement, such as ropes and cables, will be properly stored and secured when not in use.
- Littering of trash and food waste is prohibited. All litter, small artificial items (e.g., screws, washers, nuts, bolts), and food waste will be collected and disposed of from work areas on at least a daily basis.
- All fuels and components with hazardous materials or wastes will be handled in accordance with applicable regulations. These materials will be kept in segregated, secured, or secondary containment facilities as necessary. Any spills of liquid substances that could harm condors will be immediately addressed.
- The project will avoid the exposure of wildlife to antifreeze containing ethylene glycol by keeping vehicles/equipment free of leaks, particularly antifreeze, and immediately cleaning up any spills or discharges that arise from leaks.
- Polychemical lines will not be used or stored on site to preclude condors from obtaining and ingesting pieces of them.
- If a California condor lands in any work area, the Project Biologist will assess construction activities occurring at the time and determine whether those activities present a potential hazard to the individual condor. Activities determined by the Project Biologist to present a potential hazard to the condor will be stopped until the bird has abandoned the area. Methods approved by the USFWS for hazing California condors to encourage abandonment of the construction site, *Guidance on Hazing California Condors* (USFWS 2014), may be used as necessary.
- Prior to construction-related uses of helicopters, the Project Biologist will coordinate with the USFWS to establish that no California condors are present in the area. If California condors are observed in the area in which helicopters will operate (i.e., the helicopter's flight pattern from its point of origin, during construction use, and on its return flight), helicopter use will not be permitted until the Project Biologist has determined that the California condors have left the area.
- Nighttime light disturbance will be minimized in and adjacent to suitable habitat where California condors may be present. In the event that nighttime lighting is required, it will be focused, shielded, and directed away from adjacent suitable habitat, including nighttime roost areas. The Project Biologist will be on-site during nighttime light use to determine if the lighting poses a risk or otherwise disturbs or harms condors.

BIO-MM#52: Conduct Pre-Construction Surveys and Monitoring for Raptors

If construction or other vegetation removal activities are scheduled to occur during the breeding season for raptors (January 1–September 1), no more than 14 days before the start of the activities, the Project Biologist will conduct pre-construction surveys for nesting raptors in areas where suitable habitat is present. Specifically, such surveys will be conducted in habitat areas

within the work area and, where access is available. Surveys for all raptors will be conducted within 500 feet of the boundary of the work area, or within 0.5 mile of the boundary of the work area for fully protected raptors, where access is available. If breeding raptors with active nests are found, the Project Biologist will delineate a 500-foot buffer (or as modified by regulatory authorizations for species listed under the FESA or CESA) around the nest to be maintained until the young have fledged from the nest and are no longer reliant on the nest or parental care for survival or until such time as the Project Biologist determines that the nest has been abandoned. If fully protected raptors (e.g., white tailed-kite, golden eagle, American peregrine falcon, bald eagle) with active nests are found, the Project Biologist in conjunction with the contractor will establish a 0.5-mile buffer around the nest to be maintained until the young have fledged from the nest or the nest fails (as determined by the Project Biologist). Nest buffers may be adjusted if the Project Biologist determines that smaller buffers will be sufficient to avoid impacts on nesting raptors.

BIO-MM#53: Conduct Surveys for Swainson's Hawk Nests

Surveys must be performed no more than 1 year prior to the commencement of construction activities. The Project Biologist will conduct surveys for Swainson's hawk during the nesting season (March 1–August 31) within both the work area and a 0.5-mile buffer surrounding the work area, provided access to such areas is available. No sooner than 30 days prior to any ground-disturbing activity, the Project Biologist will conduct pre-construction surveys of nests identified during the earlier surveys to determine if any are occupied. The initial nesting season surveys and subsequent pre-construction nest surveys will follow the protocols set out in the *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley* (SHTAC 2000).

BIO-MM#54: Implement Avoidance and Minimization Measures for Swainson's Hawk Nests

Any active Swainson's hawk nests (defined as a nest used one or more times in the last 5 years) found within 0.5-mile of the boundary of the work area during the nesting season (March 1–August 31) will be monitored daily by the Project Biologist to assess whether the nest is occupied. If the nest is occupied, the Project Biologist will establish no-work buffers following CDFW's *Staff Report Regarding Mitigation for Impacts to Swainson's Hawks (*Buteo swainsoni*) in the Central Valley of California* (CDFG 1994), and the status of the nest will be monitored until the young fledge or for the length of construction activities, whichever occurs first.

If ground-disturbing activities or other construction activities may cause nest abandonment or forced fledging within the specified buffer area, the biological monitor will monitor the nest site to determine if the nest is abandoned. If an occupied Swainson's hawk nest tree is to be removed as a result of construction, or nest abandonment is observed during construction, an incidental take permit under CESA will be obtained and impacts will be minimized and fully mitigated.

BIO-MM#55: Provide Compensatory Mitigation for Loss of Swainson's Hawk Nesting Trees and Habitat

To compensate for permanent impacts on active Swainson's hawk nest trees (i.e., trees in which Swainson's hawks were observed building nests during protocol-level surveys described in BIO-MM#53) or recently active nest trees (i.e., trees in which Swainson's hawks have been documented as nesting within any of the previous 5 years) and foraging habitat, the Authority will provide compensatory mitigation that replaces affected nest trees and provides foraging habitat. Lands proposed as compensatory mitigation for Swainson's hawk will meet the following minimum criteria:

- Support at least three mature native riparian trees suitable for Swainson's hawk nesting (i.e., valley oak, Fremont cottonwood, or willow) for each Swainson's hawk nest tree removed by construction of the project extent
- Support at least one Swainson's hawk nesting territory in the last 5 years
- Contribute to regional conservation goals for agricultural and wildlife movement preservation where possible.

To compensate for impacts on Swainson's hawk foraging habitat, the Authority will contribute to the project's mitigation commitment for Swainson's hawk foraging habitat, which will be calculated based on the following ratios:

- 1:1 for impacts on Primary Active Foraging Habitat
- 0.75:1 for impacts on Secondary Active Foraging Habitat
- 0.5:1 for impacts on Tertiary Active Foraging Habitat

Impacts from Implementing Mitigation Measure BIO-MM#55

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#56: Conduct Surveys and Implement Avoidance Measures for Active Tricolored Blackbird Nest Colonies

Prior to initiation of construction at any location within 300 feet of suitable nesting habitat, the Project Biologist with experience surveying for and observing tricolored blackbird will conduct pre-construction surveys to establish use of nesting habitat by tricolored blackbird colonies. Surveys will be conducted in suitable habitat within 300 feet of proposed construction areas, where access allows, during the nesting season (generally March 15–July 31).

If construction is initiated near suitable habitat during the nesting season, three surveys will be conducted within 15 days prior to construction, with one of the surveys within 5 days prior to the start of construction. If active tricolored blackbird nesting colonies are identified, construction activities must avoid the nesting colonies and associated habitat during the breeding season (generally March 15–July 31) to the extent practicable within 300 feet of the colony, consistent with the CDFW's *Staff Guidance Regarding Avoidance of Impacts to Tricolored Blackbird Breeding Colonies on Agricultural Fields in 2015* (CDFW 2015). This minimum buffer may be reduced in areas with dense forest, buildings, or other habitat features between the construction activities and the active nest colony, or where there is sufficient topographic relief to protect the colony from excessive noise or visual disturbance as determined by a Project Biologist experienced with tricolored blackbird. If tricolored blackbirds colonize habitat adjacent to construction after construction has been initiated, the Authority will reduce disturbance through establishment of buffers or sound curtains, as determined by the Project Biologist.

BIO-MM#57: Provide Compensatory Mitigation for Impacts on Tricolored Blackbird Habitat

The Authority will provide compensatory mitigation required to offset impacts on tricolored blackbird. Compensatory mitigation will replace permanent loss of habitat with habitat that is commensurate with the type (nesting, roosting, and foraging) and amount of habitat lost. Suitable tricolored blackbird nesting habitat will be permanently protected or restored and managed at a ratio of 3:1 (protected or restored:affected) at a location subject to CDFW approval, and in proximity to the nearest breeding colony observed within the past 15 years, if possible. Suitable breeding season foraging habitat will be protected and managed at a ratio of 1:1 (protected:affected) at a location subject to CDFW approval. Suitable nonbreeding season foraging habitat will be protected or restored at a ratio of 1:1 (protected:affected). Compensatory mitigation will be provided using one or more of the methods described in the HMP.

Impacts from Implementing Mitigation Measure BIO-MM#57

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#58: Provide Compensatory Mitigation for Impacts on Waterfowl, Shorebird, and Sandhill Crane Habitat

The Authority will provide compensatory mitigation required to offset impacts on waterfowl and shorebirds in the UPR and GEA IBAs. Compensatory mitigation will replace permanent loss of habitat with habitat that is commensurate with the type (nesting, roosting, or foraging) and amount of habitat lost as follows:

- Suitable waterfowl and shorebird nesting and foraging habitat will be permanently protected and enhanced at a suitable location at a ratio of 1:1 (protected:affected) for permanent habitat loss; 1:1 (protected:affected) for habitat where hearing damage could result during operations (residual noise of 93 dBA or greater, as measured outside the HSR right-of-way); and 0.5:1 for habitat where arousal, visual disturbance, or masking effects result from operations (residual noise of 77 dBA or greater, as measured outside of the HSR right-of-way). Protection and enhancement of habitat will be implemented within the GEA and UPR IBAs or a suitable alternative location if locations with the IBAs are found to be infeasible in coordination with local stakeholders.
- Enhancement activities could include improved water management (to increase food supplies); improvement or replacement of water management infrastructure; vegetation control and management; contouring to increase topographic heterogeneity (to increase habitat diversity); or levee repair, maintenance, and replacement.

Impacts from Implementing Mitigation Measure BIO-MM#58

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#59: Conduct Pre-Construction Surveys for San Joaquin Kit Fox

Within 30 days prior to the start of any ground-disturbing activity, the Project Biologist will conduct pre-construction surveys in suitable kit fox habitat in the work area. The Project Biologist will conduct the surveys in accordance with USFWS' *San Joaquin Kit Fox Survey Protocol for the Northern Range* (USFWS 1999) between May 1 and September 30 for the purpose of identifying potential San Joaquin kit fox dens. All dens will be mapped and their type and status determined. Den types will be identified as defined in Exhibit A (Definitions) of the USFWS' *Standardized Recommendations for Protection of the Endangered San Joaquin Kit Fox prior to or during Ground Disturbance* (USFWS 2011). If any occupied or potential dens are found during pre-construction surveys, they will be flagged and a 50-foot no-work buffer will be established around the den until the den type is identified cleared, in accordance with regulations under the FESA and CESA, if necessary to allow construction activities to proceed. The Project Biologist may employ the use of conservation dogs (scent dogs) to augment focused species surveys using methods described in Smith et al. (2006). The Project Biologist will coordinate with USFWS and CDFW before using conservation dogs.

BIO-MM#60: Implement San Joaquin Kit Fox Avoidance and Minimization Measures

The Authority will implement USFWS' *Standardized Recommendations for Protection of the San Joaquin Kit Fox Prior to or During Ground Disturbance* (USFWS 2011) to minimize impacts on this species, including:

- Disturbance of all kit fox dens will be avoided to the extent feasible.
- Construction activities that occur within 200 feet of any occupied dens will cease within one-half hour after sunset and will not begin earlier than one-half hour before sunrise, to the extent feasible.
- All construction pipes, culverts, or similar structures with a diameter of 4 inches or greater that are stored within the construction footprint for one or more overnight period will be thoroughly inspected for kit foxes before the pipe is subsequently buried, capped, or otherwise used or moved.
- If a San Joaquin kit fox is detected within a work area during construction, the Project Biologist will request approval from the USFWS and CDFW to capture and relocate the kit fox if it does not safely leave the area by its own volition.
- To minimize the temporary impacts of WEF and construction exclusion fencing on kit fox and their movement/migration corridors during construction, artificial escape dens will be installed along the outer perimeter of WEF and construction exclusion fencing. Artificial escape dens or similar escape structures will also be installed at the entrances to temporary wildlife

crossing structures to provide escape cover and protection against predation. The artificial escape dens will be located on parcels owned by the Authority or at locations where access is available outside of work areas. The artificial escape dens will be removed at the same time as the WEF and construction exclusion fencing, once construction is complete.

BIO-MM#61: Provide Compensatory Mitigation for Impacts on San Joaquin Kit Fox Habitat

The Authority will provide compensatory mitigation for impacts on San Joaquin kit fox habitat through the acquisition of suitable habitat that is acceptable to USFWS and CDFW. Habitat will be replaced at a minimum ratio of 1:1 for high- or moderate-value suitable habitat (natural lands) and at a ratio of 0.5:1 for low-value suitable habitat (urban or agricultural lands), unless a higher ratio is required by regulatory authorizations issued under the FESA and CESA. Compensatory mitigation will be provided using one or more of the methods described in BIO-MM#10.

Impacts from Implementing Mitigation Measure BIO-MM#61

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#62: Implement Avoidance and Minimization Measures for Fresno Kangaroo Rat

Prior to any ground-disturbing activity, the Project Biologist will assess suitable habitat within the work area to determine whether kangaroo rat burrows or signs of kangaroo rats are present. If no burrows or signs of kangaroo rats are detected and kangaroo rats are determined to be absent from the work area, the Project Biologist will oversee the installation, maintenance, and monitoring of WEF along the perimeter of the work area where adjacent to potentially suitable habitat.

If kangaroo rat individuals, burrows, or signs of the presence are found within the work area during the habitat assessment, the Project Biologist will conduct protocol-level surveys for Fresno kangaroo rat in accordance with the USFWS *Survey Protocol for Determining Presence of San Joaquin Kangaroo Rats* (USFWS 2013b), or as otherwise provided pursuant to authorizations issued under the FESA and CESA.

In the unlikely event that Fresno kangaroo rat is confirmed present in the work area through the protocol-level surveys, all project activities in the work area will cease and USFWS and CDFW will be notified within 2 business days or as required under authorizations issued under the FESA or CESA. The Project Biologist will install WEF in areas where Fresno kangaroo rats are present and will establish 50-foot no-work buffers to avoid impacts on occupied habitat, unless a different buffer distance is specified under authorizations issued under the FESA and CESA.

BIO-MM#63: Provide Compensatory Mitigation for Impacts on Fresno Kangaroo Rat Habitat

Impacts on habitat occupied by Fresno kangaroo rat will be compensated for in accordance with authorizations issued under FESA and CESA through an HMP prepared in accordance with BIO-MM#10, at a minimum 1:1 ratio for potentially suitable habitat through the purchase of agency-approved bank credits or through preservation of suitable habitat (i.e., alkali sink scrub or grassland on the San Joaquin Valley floor) in perpetuity.

Impacts from Implementing Mitigation Measure BIO-MM#63

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#64: Conduct Pre-Construction Surveys for American Badger Den Sites and Implement Avoidance and Minimization Measures

Prior to any ground-disturbing activity, the Project Biologist will conduct pre-construction surveys for American Badger den sites within suitable habitat located within the work area. These surveys will be conducted no less than 14 days and no more than 30 days prior to the start of ground-disturbing activities in a work area. The Project Biologist will establish a 100-foot no-work buffer around occupied maternity dens throughout the pup-rearing season (February 15–July 1) and a 50-foot no-work buffer around occupied dens during other times of the year. If nonmaternity dens are found and cannot be avoided during construction activities, they will be monitored for badger

activity. If the Project Biologist determines that dens may be occupied, passive den exclusion measures will be implemented for 3–5 days to discourage the use of these dens prior to project disturbance activities.

BIO-MM#65: Conduct Pre-Construction Surveys for Ringtail and Ringtail Den Sites and Implement Avoidance Measures

Prior to any ground-disturbing activity, the Project Biologist will conduct pre-construction surveys for ringtail and ringtail den sites in suitable habitat within the work area. These surveys will be conducted no more than 30 days before the start of ground-disturbing activities in a work area. The Project Biologist will establish 100-foot no-work buffers around occupied maternity dens throughout the pup-rearing season (May 1–June 15) and a 50-foot no-work buffer around occupied dens during other times of the year.

BIO-MM#66: Conduct Pre-Construction Surveys for Dusky-Footed Woodrat and Implement Avoidance Measures

Prior to any ground-disturbing activity, the Project Biologist will conduct pre-construction surveys for woodrat stick houses within suitable habitat located within the work area. These surveys will be conducted no more than 14 days before the start of ground-disturbing activities in a work area. The Project Biologist will establish a 50-foot no-work buffer around each stick house using ESA fencing. If stick houses are found within temporary or permanent impact areas and cannot be avoided, the following condition will be implemented:

- Removal of woodrat stick houses will not occur between March and May when nesting is most likely. Outside this period, the contractor, under supervision of the Project Biologist, may dismantle stick houses by hand or using small construction machinery (e.g., Bobcat or similar) and move nesting material to suitable habitat outside the project footprint so that woodrats may rebuild new houses.

BIO-MM#67: Conduct Pre-Construction Surveys for Special-Status Bat Species

No more than 1 year before the replacement or modification of any bridges or removal of other structures modeled as bat habitat and where access is available, the Project Biologist will conduct a survey of the bridge looking for evidence of roosting bats. If bat sign is detected, biologists will conduct an evening visual emergence survey of the bridge or structure, from a half hour before sunset to 1–2 hours after sunset for a minimum of 2 nights within the season that construction will be taking place. If a potentially active bat roost is in the bridge or structure, passive monitoring with full-spectrum bat detectors will be used to assist in determining species present. To the extent possible, all monitoring will be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted). The biologists will analyze the bat call data using appropriate software and will prepare a report that will be submitted to the Authority, including an assessment of the significance of the roost for local bat populations.

BIO-MM#68: Implement Bat Avoidance and Relocation Measures

If active hibernacula or maternity roosts are identified in the work area or 500 feet extending from the work area during pre-construction surveys, they will be avoided to the extent feasible. If avoidance of a hibernacula is not feasible, the Project Biologist will prepare a relocation plan to remove the hibernacula and provide for construction of an alternative bat roost outside of the work area. The relocation plan will be provided to CDFW for review and input. The Project Biologist will implement the relocation plan before the commencement of any ground-disturbing activities that will occur within 500 feet of the hibernacula. Removal of roosts will be guided by accepted exclusion and deterrent techniques.

BIO-MM#69: Implement Bat Exclusion and Deterrence Measures

If nonbreeding or nonhibernating individuals or groups of bats are found roosting within the work area, the Project Biologist will facilitate the eviction of the bats by either opening the roosting area to change the lighting and airflow conditions, or installing one-way doors or other appropriate methods.

To the extent feasible, the Authority will leave the roost undisturbed by project activities for a minimum of 1 week after implementing exclusion and/or eviction activities. Steps will not be taken

to evict bats from active maternity or hibernacula; instead, such features may be relocated pursuant to a relocation plan. If a relocation plan is necessary, the Authority will develop it in consultation with CDFW and/or other experts as necessary.

BIO-MM#70: Prepare and Implement an Annual Vegetation Control Plan

Prior to O&M of the HSR, the Authority will prepare an annual vegetation control plan (VCP) to address vegetation removal for the purpose of maintaining clear areas around facilities, reducing the risk of fire, and controlling invasive weeds during the operational phase. The Authority will generally follow the procedures established in Chapter C2 of the California Department of Transportation (Caltrans) Maintenance Manual to manage vegetation on Authority property (Caltrans 2014). Vegetation will be controlled by chemical, thermal, biological, cultural, mechanical, structural, and manual methods. The VCP will be updated each winter and completed in time to be implemented no later than April 1 of each year. The annual update to the VCP will include a section addressing issues encountered during the prior year and changes to be incorporated into the VCP. The plan will describe site-specific vegetation control methods, as outlined below:

- Chemical vegetation control methods
- Mowing program consistent with Section 1415 of the FAST Act
- Other nonchemical vegetation control
- Other chemical pest control methods (e.g., insects, snail, rodent)

Only Caltrans-approved herbicides may be used in the vegetation control program. Pesticide application will be conducted by certified pesticide applicators in accordance with all requirements of the California Department of Pesticide Regulation and County Agricultural Commissioners. Noxious/invasive weeds will be treated where requested by County Agricultural Commissioners. The Authority will cooperate in area-wide efforts to control noxious/invasive weeds if such programs have been established by local agencies.

To the extent feasible and consistent with the Caltrans (2014) Maintenance Manual requirements, the Authority will also include pollinator conservation measures in the VCP from the Xerces Society *Best Management Practices for Pollinators on Western Rangelands* (Xerces Society 2018), conservation measures in the *Nationwide Candidate Conservation Agreement for Monarch Butterfly on Energy and Transportation Lands* (Cardno 2020), or other applicable sources.

BIO-MM#71: Restore Temporary Riparian Impacts

Within 90 days of completing construction in a work area, the Project Biologist will direct the revegetation of any riparian areas temporarily disturbed as a result of the construction activities, using appropriate native plants and seed mixes. Native plants and seed mixes will be obtained from stock originating from local sources, to the extent feasible. The Project Biologist will monitor restoration activities consistent with provisions in the RRP (BIO-MM#1).

BIO-MM#72: Provide Compensatory Mitigation for Permanent Impacts on Riparian Habitat

The Authority will compensate for permanent impacts on riparian habitats at a ratio of 2:1 (mixed riparian and palustrine forested wetland) or 4:1 (California sycamore woodland), unless a higher ratio is required by agencies with regulatory jurisdiction over the resource. Compensatory mitigation may occur through habitat restoration, the acquisition of credits from an approved mitigation bank, participation in an in-lieu fee program or habitat preservation or enhancement at a permittee responsible mitigation site. Mitigation nearest the location of impact will be prioritized, as feasible, unless the conservation value will be greatest in another location.

Impacts from Implementing Mitigation Measure BIO-MM#72

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#73: Restore Aquatic Resources Subject to Temporary Impacts

Within 90 days of the completion of construction activities in a work area, the Authority will begin to restore aquatic resources that were temporarily affected by the construction. As set out in the

RRP (BIO-MM#1), such areas will be, to the extent feasible, restored to their natural topography. In areas where gravel or geotextile fabrics have been installed to protect substrate and to otherwise minimize impacts, the material will be removed and the affected features will be restored. The Authority will revegetate affected aquatic resources using appropriate native plants and seed mixes (from local sources where available). The Authority will conduct maintenance monitoring consistent with the provisions of the RRP.

BIO-MM#74: Prepare and Implement a Compensatory Mitigation Plan for Impacts on Aquatic Resources

The Authority will prepare and implement a compensatory mitigation plan (CMP) that identifies mitigation to address temporary and permanent loss, including functions and values, of aquatic resources as defined as waters of the U.S. under the federal CWA and/or waters of the state under the Porter-Cologne Act. The compensatory mitigation for state- and federally protected wetlands will meet the federal and state policy for no net loss of functions and values. Mitigation implemented under this measure will be consistent with and will help advance mitigation commitments at the program level, including mitigation intended to address impacts in the GEA. Compensatory mitigation may involve the restoration, establishment, enhancement, and/or preservation of aquatic resources through one or more of the following methods:

- Purchase of credits from an agency-approved mitigation bank
- Preservation of aquatic resources through acquisition of property
- Establishment, restoration, or enhancement of aquatic resources
- In-lieu fee contribution determined through consultation with the applicable regulatory agencies

The following ratios will be used for compensatory mitigation for permanent impacts, unless a higher ratio is required pursuant to regulatory authorizations issued under Section 404 of the CWA and the Porter-Cologne Act:

- Vernal pools: 2:1
- Seasonal wetlands: between 1.1:1 and 1.5:1 based on impact type, function and values lost
  - 1:1 off-site for permanent impacts
  - 1:1 on-site and 0.1:1 to 0.5:1 off-site for temporary impacts
- All other wetland types: 1:1
- All non-wetland types: mitigated onsite at 1:1 or offsite 1:1 if onsite mitigation is not possible.

For permittee-responsible mitigation involving establishment, restoration, enhancement, or preservation of aquatic resources by the Authority, the CMP will contain, but will not be limited to the following primary information:

- Objectives—A description of the resource types and amounts that will be provided, the type of compensation (i.e., restoration, establishment, enhancement, and/or preservation), and the manner in which the resource functions of the compensatory mitigation project will address the needs of the watershed or ecoregion
- Site selection—A description of the factors considered during the term sustainability of the resource
- Adaptive management plan—A management strategy to address changes in site conditions or other components of the compensatory mitigation project
- Financial assurances—A description of financial assurances that will be provided to support success of the compensatory mitigation

Additional information required in a CMP as outlined in 33 CFR 332.4(c), as deemed appropriate and necessary by the USACE, will also be addressed in the CMP. In circumstances where the Authority intends to fulfill compensatory mitigation obligations by securing credits from approved mitigation banks or in-lieu fee programs, the CMP need only include the name of the specific mitigation bank or in-lieu fee program to be used, the number of credits proposed to be purchased, and a rationale for why this number of credits was determined appropriate.

Impacts from Implementing Mitigation Measure BIO-MM#74

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#75: Implement Transplantation and Compensatory Mitigation for Protected Trees

Prior to ground-disturbing activities, the Project Biologist will conduct surveys in the work area to identify protected trees.

The Project Biologist will establish ESAs around protected trees with the potential to be affected by construction activities, but do not require removal. The contractor, under the direction of the Project Biologist, will install ESA fencing within the root protection zone. The root protection zone extends beyond the dripline to a distance that is half the distance between the trunk and the dripline.

The Authority will provide compensatory mitigation for impacts on protected trees, including impacts associated with removing or trimming a protected tree. Compensation will be based on requirements set out in applicable local government ordinances, policies, and regulations. Compensatory mitigation may include, but is not limited to, the following:

- Transplantation of protected trees to areas outside of the work area.
- Replacement of protected trees at an off-site location, based on the number of protected trees affected, at a ratio not to exceed 3:1 for native trees (except for native oak trees, which will be replaced at a ratio not to exceed 6:1) or 1:1 for ornamental trees, unless higher ratios are required by local government ordinances or regulations.
- Contribution to a tree-planting fund.

The Authority will develop a native oak/protected tree mitigation plan for oak and other protected trees that are transplanted or replaced. The oak/protected tree mitigation plan will include the following:

- The number of affected oak trees and the number of transplanted and replaced native oak trees.
- A description of the mitigation site and reference site locations.
- A planting plan that includes planting acorns and understory species.
- A description of the success criteria that will be used to evaluate performance. Success criteria will be defined to achieve approximate baseline conditions at a minimum.
- A description of the types of monitoring that will be used to verify that such criteria have been met. Monitoring will occur for a minimum of 10 years.
- A description of the management actions that will be used to maintain the habitat on the mitigation sites and the funding mechanisms for long-term management.
- A description of remedial actions that will be used if the success criteria are not met.
- A description of financial assurances that will be provided to demonstrate that the funding to implement mitigation is assured.

BIO-MM#76a: Minimize Impacts on Wildlife Movement during Construction

During construction, all known wildlife crossing structures, such as underpasses and culverts, will be maintained unobstructed; no equipment storage, staging, or unnecessary operations will be conducted in such areas. Where an existing underpass or culvert must be closed or obstructed, a temporary crossing structure or an alternative movement corridor will be created. Construction will be timed to minimize impacts on movement by providing at least one crossing feature in a region. For example, to minimize impacts on wildlife using the Fisher Creek culvert, construction at Fisher Creek will not commence until the construction of the Tulare Swale undercrossing is complete.

Directional fencing will be placed to funnel individuals to temporary or alternative crossing structures or movement corridors.

The Authority will avoid placing fencing, either temporarily or permanently, within known movement routes for wildlife (e.g., the Fisher Creek underpass or culverts and bridges that provide passage under SR 152 in western Pacheco Pass) in those portions of the alignment where the tracks are elevated (e.g., viaducts or bridges). The Authority will avoid conducting ground-disturbing activities within known wildlife movement routes during nighttime hours, to the extent feasible, and will shield nighttime lighting to avoid illuminating wildlife movement corridors in circumstances where feasible.

The Authority will also avoid conducting ground-disturbing activities within known wildlife movement routes during nighttime hours (1 hour before sunset to 1 hour after sunrise), to the extent feasible. Where nighttime work is necessary, the Authority will minimize impacts on adjacent lands by preparing a site-specific lighting information plan. The plan will provide the number of lights to be utilized, the type of lights to be used (i.e., LED, incandescent, or halide), the lumens of the lights, how the lights will be shielded and directed downward, as well as a map that shows the work area, lighting locations, and the orientation of how lighting will be directed. Lighting will use the minimum levels approved by OSHA (29 C.F.R. § 1926.56) for general construction (i.e., 5 foot-candles or 54 lux). Additionally, the plan will include instructions to minimize the direction of construction vehicle headlights toward off-site locations and using low beams or turning off headlights when safety considerations permit. The plan will require minimizing the duration of lighting by using methods other than lighting to ensure security of the construction site during hours it is not in use.

To avoid impeding movement of aquatic species, the Authority will employ the use of vibratory (rather than impact) pile driving for work in or within 200 feet of waterbodies that provide habitat for steelhead or giant garter snake. To allow for movement of steelhead and other fish species around dewatered sites, the capture and translocation of fish around the job site to a downstream location will be undertaken on consultation with the NMFS and CDFW.

Additionally, the Authority will establish wildlife-friendly fencing at soil stabilization areas and tunnel portals (which occur through the Pacheco Pass region) where a large right-of-way will be required. While access restriction fencing directly adjacent to the rail, tunnel portals, and HSR facilities will still be necessary for human safety and security, it will not be necessary around the larger construction footprints necessary for soil stabilization areas and tunnel portal work areas. Within these areas, a wildlife-friendly fence will be used with the following attributes (Paige 2012):

- Three- or four-strand wire design
- No more than 40 inches tall (to allow adult mammals to jump over)
- Bottom 18 inches off the ground (to allow animals to crawl under) (changes in topography such as gullies or dips can be used to provide this clearance distance)
- At least 12 inches between the top two wires
- Smooth top and bottom wires
- No vertical stays between posts; if stays are necessary, consider stiff plastic or composite stays
- Wood or steel posts at 16.5-foot intervals
- Gates, drop-downs, or other passage where wildlife can concentrate and cross
- Flagging or other measure to increase fence visibility (especially important for low-flying birds)

BIO-MM#76b: Minimize Impacts on Wildlife Movement in the Western Pacheco Pass Region

The Authority will implement measures within the western Pacheco Pass region (e.g., the Pacheco Creek Reserve and adjacent areas) to facilitate wildlife movement during construction. To offset noise, visual, lighting, and ground disturbance effects during construction, the Authority will identify, create, and maintain at least two wildlife movement routes through and/or around the construction area to facilitate continued wildlife movement. Wildlife movement areas will be established between natural lands to the east, west, and south of the construction area and existing wildlife crossing location under SR 152.The routes will be fenced on one or both sides to help funnel animals through or around the construction area, will be as wide as possible, and will include predator avoidance cover as well as open areas that provide line of sight. Noise walls will be used, where needed, to create the minimum noise conditions possible. The Authority will consult with SCVHA, Pathways for Wildlife, and other subject matter experts as necessary to identify existing bridges, culverts, and undercrossings under features such as SR 152 that will be suitable crossing locations for this measure.

The wildlife movement routes will be established prior to construction, adjusted if necessary, and will be maintained and monitored (using camera stations or other appropriate methods) during construction to ensure that, at any one time, at least two routes are maintained. The corridors will be maintained in a dark state (i.e., shielded from construction-related lighting) if possible. The Authority will work with agency and stakeholder partners—CDFW, USFWS, NMFS, the SCVOSA, SCVHA, Peninsula Open Space Trust, and The Nature Conservancy—to site and design the temporary movement routes.

BIO-MM#77a: Design Wildlife Crossings to Facilitate Wildlife Movement

The Authority will design all wildlife crossings created specifically for terrestrial species consistent with the guidelines and recommendations in the WCA (Authority 2020a: Appendix C). The design of wildlife crossings will include the following features:

- To improve use of wildlife crossings, install directional fencing for the maximum feasible distance from each side of wildlife crossing entrances/exits along Monterey Road between Metcalf Road and Tilton Avenue (i.e., within Coyote Valley) under all alternatives. Directional fencing will be designed to benefit the greatest number of movement guilds feasible.
- Wildlife crossing width and height will be maximized and length minimized to the extent feasible.
- Native earthen bottom
- Avoid metal walls
- Unobstructed entrances (e.g., no riprap, energy dissipaters, grates), although vegetative cover, adjacent to and near the entrances of crossings, is permissible
- Openness and a clear line of sight from end to end
- Design entrances to minimize light reflection from train lights
- Cover materials within the crossing such as rock or brush piles where smaller animals can take cover
- Year-round absence of water for a portion of the width of the crossing (i.e., no flowing water)
- Where water is likely to be present within a crossing as a result of a high groundwater table or proximity to an existing floodplain, wildlife crossing design will include features to minimize water entry into the crossing (e.g., impermeable groundwater barriers, berms) and to maximize drainage and drying time (e.g., slopes, sump pumps or permeable soils)
- Where hydrologic flow balancing features (culverts) provide wildlife connectivity, "shelves" will be constructed, where feasible, to allow small and medium animals to pass through the structure when it is flooded

- Slight grade at approaches to prevent flooding
- Hydrologic designs (ledges, cross slopes, water detention features, infiltration features, water proofing, or other features) to maintain crossing functionality (a dry crossing path) up to and including 100-year storm events for 95 percent of the year (347 days)
- Limited open space distance and absence of permanent physical obstacles between crossing and cover/habitat
- Separation from human use areas (e.g., trails, multiuse undercrossings, development)
- Avoidance of artificial light at approaches to wildlife crossings
- The addition of directional fencing in other important wildlife corridors (e.g., the western Pacheco Pass region) to funnel wildlife to crossing structures
- Consideration of habitat modification and/or habitat restoration at crossings to facilitate cover for crossing animals
- To mitigate impenetrable barriers caused by construction of concrete vehicle barriers beneath viaducts in the Monterey Corridor and Morgan Hill and Gilroy Subsections (Alternatives 1 and 3), install Type L Concrete Barrier Wildlife Passageways at stations 718, 735, 755, 846, and 875

Because land use and other factors could change prior to construction of the project, the Authority will work with agency and stakeholder partners (e.g., CDFW, USFWS, NMFS, SCVOSA, SCVHA, Peninsula Open Space Trust, and The Nature Conservancy) to validate and optimize wildlife crossing locations at the 75 to 90 percent design phase. The adjustment of some crossing locations, and the spacing of crossings, up to approximately 0.1 mile, may be necessary to orient crossings most advantageously to protected and natural lands, which is likely to improve the potential for use. In addition, the Authority will plan and prioritize species and wetland and natural community (e.g., sycamore alluvial wetland) mitigation land acquisition—in coordination with the agencies and stakeholders listed above—at or near wildlife crossing entrances to minimize future development and maintain the natural and rural land cover types surrounding wildlife crossing entrances and exits.

Further, the Authority will prepare and submit for review a Wildlife Crossing Design, Inspection, and Maintenance Plan. The plan will include the following minimum components:

- A list of movement guild focal species for each wildlife crossing and hydrologic balancing features along the alignment
- Based on the focal species, identification of which of the above-listed design features (e.g., vegetation at the entrance, cover within the crossing, artificial dens for San Joaquin kit fox, critter shelves) will be included in each crossing's design
- A funnel fencing plan for wildlife crossing entrances/exits on the east side of Monterey Road in Coyote Valley
- Frequency of crossing design inspection
- A list of features to be inspected, criteria for passing inspection, and the response for failed inspection
- A description of how maintenance decisions will be informed by the wildlife crossing monitoring and adaptive management plan described below in BIO-MM#77b

The Wildlife Crossing Design, Inspection, and Maintenance Plan will be developed in coordination with wildlife agencies—CDFW, USFWS, and NMFS—and local wildlife movement stakeholders (e.g., SCVOSA, SCVHA, Peninsula Open Space Trust, and The Nature Conservancy).

BIO-MM#77b: Monitoring and Adaptive Management of Wildlife Crossings
The Authority will develop a monitoring and adaptive management plan to monitor the effectiveness and use of crossing designs. The plan will include the following minimum components:

- **Monitoring methods**—Consistent with local monitoring efforts, which primarily use camera stations and other remote sensing equipment to document use and passage rates, monitoring will be focused on crossings within defined wildlife movement corridors. To the extent feasible, the Authority could also contribute funding to local organizations currently conducting wildlife movement monitoring to meet monitoring requirements outlined in the measure, provided the efforts are occurring within the same defined wildlife movement corridors.
- **Monitoring**—Monitoring will start no less than 2 years following construction (to allow time for habituation), and total initial monitoring period will not exceed 5 years following construction. Additional monitoring associated with adaptive management will be confined to the location triggering the adaptive management and will not exceed 5 years.
- **Success criteria**—Wildlife crossings have been designed with minimum dimensions and design criteria for the different movement guilds, as considered in the WCA. Crossings will be considered successful if they are documented during monitoring as having use by one or more of the species guilds they are designed for. The adaptive management plan will outline species and species guild targets for each size and type of wildlife crossing constructed, based on the design criteria and associated expected use of each crossing as outlined in the WCA.
- **Adaptive management**—Adaptive management will include modifications to design features, if feasible, such as cover and substrate; use of new technologies to attract animals to the crossing; fencing; adjacent land management changes, if feasible; or other measures that may be determined to be feasible in the future.

The monitoring and adaptive management plan will be developed in coordination with wildlife agency staff and local wildlife movement stakeholders such as SCVHA, SCVOSA, The Nature Conservancy, and Peninsula Open Space Trust.

BIO-MM#78: Establish Wildlife Crossings at Embankment in West Slope of Pacheco Pass
The Authority will create dedicated wildlife crossings to accommodate wildlife movement across permanently fenced infrastructure in the western portion of the Pacheco Pass Subsection near Casa de Fruta, where wildlife movement will be significantly reduced. Dedicated wildlife crossings will be implemented using one or more methods. The Authority will either construct short segments of open-span bridge/viaduct or will install dedicated wildlife undercrossings. The area proposed for the crossings is known to be geologically unstable, and the Authority has committed to evaluating the area through detailed geotechnical analysis. The wildlife crossing type used will prioritize the use of open-span bridge/viaducts; however, the methods used will depend on the results of detailed geotechnical analysis to ensure safety and security of the rail is considered first.

Wildlife undercrossings, if used, will be placed approximately every 0.3 mile and will be no longer than 120 feet, as feasible, where the alignment is at grade, on embankment, or trenched at the following locations:

- Crossing A: B3161+34: 120 feet long by 40 feet wide by 23 feet high.
- Crossing B: B3174+00: 120 feet long by 40 feet wide by 38 feet high
- Crossing C: B3197+00: 120 feet long by 40 feet wide by 38 feet high
- Crossing D: B3209+98: 120 feet long by 40 feet wide by 38 feet high

Undercrossings will conform to the minimum spacing and dimensions set forth in the WCA (Authority 2020a: Appendix C) with the exception of length, which will be limited to no more than 120 feet where feasible, unless different dimensions or frequencies are specified in authorizations issued under the FESA or CESA. Additionally, to the extent feasible, specific designs will

incorporate the features outlined under BIO-MM#77a to facilitate wildlife movement through dedicated crossings.

Open-span bridge/viaducts, if used, will also be placed approximately every 0.3 mile, in the locations noted above, and will be at least 100 feet long. Additionally, to the extent feasible, the bridge/viaducts will be at least 15 feet in height. The Authority may also use some combination of wildlife undercrossings and open-span bridges/viaducts, if the geotechnical analysis indicates some areas are more suitable for a certain type of structure than others.

Mitigation to change the design from embankment to open-span bridges or viaducts (if determined to be feasible) could result in some secondary impacts on visual resources, hydrology, or biological resources; however, these impacts would generally be less than those required to construct a large embankment. The measures set forth in BIO-MM#11 would also be implemented to minimize any adverse impacts from this on-site mitigation. Overall, however, the design change would be expected to result in beneficial effects.

BIO-MM#79a: Provide Wildlife Movement between the Santa Cruz Mountains and Diablo Range

The Authority will address effects of permeability reduction caused by construction of the MOWF, HSR guideway, and secured right-of-way, an impact that could not feasibly be avoided. Within 2 years of the start of construction at the MOWF, the Authority will conserve or improve wildlife movement within the Santa Cruz Mountain to the Diablo Range, Santa Cruz Mountain to Gabilan Range, or the Diablo to Gabilan Range wildlife linkages (Penrod et al. 2013) by conserving natural or agricultural lands that provide for wildlife movement, enhancing wildlife movement between the Santa Cruz Mountains and the Diablo Range, or both.

The extent of preservation or enhancement will provide for one of the following:

- An increase in permeability of the Santa Cruz Mountains to Diablo Range Wildlife Linkage (as mapped by Penrod et al. 2013) and the Soap Lake 100-year floodplain equivalent to the decrease in permeability at the MOWF in its combination of magnitude and affected area
- Protection of 238 acres (Alternatives 1, 2, and 4) or 239 acres (Alternative 3) of lands prioritized for their importance to wildlife movement in the Santa Cruz Mountains to Diablo Range Wildlife Linkage and the Soap Lake 100-year floodplain, which corresponds to a 1-to-1 ratio of protected land to project footprint at the MOWF
- A combination of enhancement and protection where the implemented percentages of the above enhancement and preservation combine to 100 percent

Acquisition and enhancement efforts listed above will prioritize lands in either the Santa Cruz Mountains to Diablo Range Wildlife Linkage or the Soap Lake 100-year floodplain, particularly along known wildlife movement routes or corridors, especially those adjacent to or near wildlife crossing structures under UPRR, Monterey Road, and the HSR. The protection of open space corridors between wildlife undercrossings and the nearest conserved open space, floodplain, passive recreation, or open agricultural properties will be prioritized when necessary to maintain and facilitate the permanent functionally of wildlife crossings. The prioritization of lands for protection will be developed in coordination with local stakeholders, such as the SCVHA, the SCVOSA, The Nature Conservancy, the Peninsula Open Space Trust, and with wildlife agency staff.

Preservation of natural or agricultural lands will be in perpetuity through either fee title acquisition or conservation easement.

Enhancement efforts may include enhancement of movement on lands protected by the Authority, or it may entail funding projects that will enhance movement on other protected lands, reduce or eliminate existing barriers to movement, or construct structures to improve wildlife movement.

Impacts from Implementing Mitigation Measure BIO-MM#79a

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#79b: Provide Wildlife Movement between the Diablo Range and Inner Coast Range

Under this measure within the western Pacheco Pass Region, the Authority will design, permit, and construct a wildlife overcrossing, or will contribute funds to the SCVHA for the design, permitting, and construction of a wildlife overcrossing under an agreement with SCVHA (i.e., a Mitigation Credit Agreement or another appropriate funding mechanism that would ensure that a wildlife overcrossing is constructed). To facilitate the implementation of this measure, the Authority will establish a Pacheco Wildlife Movement Working Group, focused on the funding, design, permitting, and construction of a wildlife overcrossing in the region. The wildlife overcrossing would be located and designed through coordination with the working group which will include representatives from Caltrans, wildlife agencies (CDFW, USFWS) and local wildlife movement stakeholders (e.g., SCVOSA, SCVHA, Peninsula Open Space Trust, and The Nature Conservancy). The wildlife overcrossing design and characteristics would be consistent with, and meet the minimum requirements outlined in the Wildlife Crossing Structure Handbook (Clevenger and Huijser 2011), and consistent with guidelines within the Innovative Strategies to Reduce the Costs of Effective Wildlife Overpasses (McGuire et al. 2021), or other published applicable wildlife overcrossing design or construction guidance. To the extent consistent with the coordination and guidance described above, the wildlife overcrossing will be located east of the Pacheco Creek Reserve and west of the Santa Clara County boundary (the Authority in consultation with wildlife agencies and local wildlife movement stakeholders may adjust the location to the most appropriate location with the region). Preliminary evaluations of suitable and efficient site locations indicate a wildlife overcrossing structure in the region would require a one or two span structure with a length of approximately 200 feet and a width of up to 130 feet. Preliminary evaluations also indicate that a pre-cast concrete arch approach is the least-cost solution, but the design requires additional validation in terms of site requirements and constructability. If a pre-cast arch bridge is infeasible the Authority assumes a typical reinforced concrete bridge would be used, as described below. Funding for the wildlife overcrossing will come from the Authority to the extent necessary, however the Authority will also seek other funding partners and sources, including wildlife movement stakeholders in the region, through other cost sharing agreements (e.g.,Caltrans, CDFW), and through other state or local funding sources (e.g., California Wildlife Conservation Board Prop 68 funding, SCVHA funding, etc.). Additionally, the Authority will fund an endowment (the amount will be estimated using a PAR [property analysis record] or PAR-like analysis) to address the long-term monitoring and maintenance of the wildlife overcrossing. To the extent feasible, construction of the land bridge will be conducted prior to construction of the Pacheco Pass Subsection or as soon as possible after construction begins. For these reasons the Authority will either fund and built via a partnership with SCVHA, or independently construct, maintain and operate a wildlife overcrossing as follows:

- A pre-cast concrete arch wildlife overcrossing of no more than 130 feet in width and no more than 300 feet in length, utilizing a location that maximizes ease of construction and cost considerations (such as a location with an adequate median width that a bridge can use two arches to span opposing lanes of traffic), and suitable habitat can be connected, or
- A single typical reinforced concrete bridge with one single span no more than 130 feet in width at a location where a bridge of no more than approximately 200 feet in length would span suitable habitats.

Impacts from Implementing Mitigation Measure BIO-MM#79b

Construction of the wildlife overcrossing could also result in secondary impacts such as impacts to biological resources including species habitat, aesthetics, air quality, cultural resources, or transportation; however, most of these impacts are expected to be minor because the overcrossing would be located within the existing SR 152 corridor which is already significantly disturbed. If construction is undertaken by a third party, the wildlife overcrossing would undergo

additional environmental review by the entity that implements the overcrossing. If the Authority constructs the overcrossing, BIO-MM#11 would also be applied to minimize biological impacts from the wildlife overcrossing. Overall, however, construction of a wildlife overcrossing is expected to result in beneficial effects. In conclusion, there are no new unique impacts associated with the wildlife overcrossing that have not already been evaluated and addressed in other sections of this Final EIR/EIS.

BIO-MM#80: Minimize Permanent Intermittent Noise, Visual, and Train Strike Impacts on Wildlife Movement

To address the permanent intermittent impact of noise, visual disturbance, and train strike on movement by avian and mammalian wildlife, the Authority will build additional structures to minimize or avoid such impacts. Structures will be designed with the goal of reducing or eliminating the visual presence of the moving train and minimizing exposure to noise produced by HSR trains.

With regard to birds, the noise/visual barriers will be designed to minimize exceedance of the following thresholds (as measured at the outer edges of the HSR right-of-way), as described in the WCA:

- Permanent hearing damage: 140 dBA or greater
- Temporary hearing damage: 93 dBA or greater but less than 140 dBA
- Masking: 84 dBA or greater but less than 93 dBA
- Arousal: 77 dBA or greater but less than 84 dBA

To this purpose, the Authority will build opaque noise/visual barriers to cover or obscure some or all of the train, including the OCS, if feasible, at the following locations:

- In the GEA IBA near Volta, between Stations B4550+00 and B4630+00 (all alternatives)
- In the UPR IBA (corresponding to the 10-year Pajaro River floodplain), between Stations B1932+00 and B2164+00 (Alternatives 1, 2, and 4)
- In the UPR IBA between Stations B1870+00 and B2097+00 (Alternative 3)

The noise/visual barriers will be a minimum height of 17 feet and will be designed to provide a minimum of 10 dBA attenuation of sound generated by HSR operations, as measured 50 feet from the noise barrier. The noise/visual barriers will be constructed in conjunction with the installation of track and OCS and will be completed before HSR train operations begin. With the TDV, those same 17-foot-high noise barriers will be effective at reducing noise from trains going 220 mph (as they will for trains going 200 mph), but the area with noise above the thresholds will be somewhat larger than the alternatives without the TDV. As a result, the TDV will increase the acreage of different land cover types exposed to sound exceeding the thresholds as compared to the alternatives without the TDV.

Under all alternatives, for approximately 3.4 miles In the GEA IBA, centered approximately at Mud Slough between Stations B4914+00 and B5095+00, the rail design will be modified to enclose the train's operating envelope and OCS. The enclosure will be constructed using opaque, nonglare materials that provide a minimum of 10 dBA attenuation of sound generated by HSR operations, as measured 50 feet from the enclosure. The enclosure will also be designed to minimize sound generated by HSR train exit and entry. The Authority will design the guideway enclosure in compliance with all HSR design, operations, and maintenance requirements, including but not limited to:

- Train performance
- Passenger comfort
- Fire-life-safety readiness and response
- Loading to viaduct girder structure and embankment foundation
- 100-year service life under suitable, acceptable maintenance practices and costs

The guideway enclosure will be constructed in conjunction with the installation of track and OCS and will be completed before HSR train operations begin. A preliminary engineering feasibility analysis is provided in Appendix 3.7-C, HSR Guideway Enclosure for the Grasslands Ecological Area.

If structure designs in the UPR and GEA IBAs can be demonstrated through quantitative modeling to reduce sound levels outside the HSR right-of-way to less than 77 dBA, no additional measures will be necessary. If residual noise of 77 dBA or more (as measured outside the HSR right-of-way) is still demonstrated, and therefore will exceed one or more of the quantitative noise thresholds, HSR will implement the compensatory mitigation approach described in BIO-MM#58, which requires compensatory mitigation for lost habitat for waterbirds. The amount of compensatory mitigation required under BIO-MM#58, if implemented in concert with this mitigation measure, will depend on the extent of noise reduction that can be demonstrated using noise barriers or enclosures. Mitigation implemented under this measure will be consistent with and will help advance mitigation commitments at the program level, including mitigation intended to address impacts in the GEA.

With regard to mammals, potential noise and visual impacts include reduced habitat suitability if train noise or visual impacts impair an animal's ability to forage, evade predators, or conduct other essential behaviors and possible deterrence from crossing the rail alignment at locations intended by HSR design. The noise/visual barriers will be sited to minimize the risk of deterrence on movement corridors critical to the San Joaquin kit fox and the mountain lion. To this purpose, the Authority will build noise/visual barriers at the following locations:

- In Coyote Valley to protect the wildlife crossings sited between Stations B0648+80 and B0664+85 (Alternatives 1 and 3)
- In Coyote Valley to protect the wildlife crossings sited between Stations B0739+45 and B0754+80 (Alternative 2)
- In Coyote Valley to protect the wildlife crossings sited between Stations B0689+00 and B0704+00 (Alternative 4)
- In upper Pacheco Creek between Stations B3254+70 and B3303+00 (all alternatives)
- At the crossing of the California Aqueduct at Stations B4248+00 to B4249+00 (all alternatives)

The noise/visual barriers will be a minimum height of 17 feet and will be designed to provide a minimum of 10-dBA attenuation of sound generated by HSR operations, as measured 50 feet from the noise/visual barrier. Noise/visual barriers installed at the Tulare Swale and Fisher Creek wildlife crossing structures in Coyote Valley (under Alternatives 2 and 4) will extend no less than 720 feet beyond the stationing limits stated above. Noise/visual barriers installed on viaduct sections of the alignment (Coyote Valley, Alternatives 1 and 3; upper Pacheco Creek and California Aqueduct crossing, all alternatives) will extend no less than 555 feet beyond the stationing limits stated above. The noise/visual barriers will be constructed in conjunction with the installation of track and OCS and will be completed before HSR train operations begin. These length-of-barrier specifications are intended to ensure that the barrier creates a zone of minimized noise, extending several hundred feet from the alignment, that will serve as an attraction cue for animals using sound to locate the crossing locations.

The Authority will consult with CDFW, USFWS, Grasslands Water District, the owner(s) of private properties where noise/visual barriers will be placed, and other local wildlife movement stakeholders as part of final design of noise barriers and the guideway enclosure.

Impacts from Implementing Mitigation Measure BIO-MM#80

The construction of noise/visual barriers could result in secondary impacts on visual resources. These secondary impacts are discussed in Section 3.4, Noise and Vibration, under Mitigation Measure NV-MM#3.

BIO-MM#81: Minimize Permanent Intermittent Impacts on Terrestrial Species Wildlife Movement

To address the permanent intermittent impact of operations on wildlife movement from train strike and entrapment, the Authority will implement an array of exclusion features for terrestrial species. These features include the following, which are specified in detail in the WCA (Authority 2020a: Appendix C):

- Permanent, 8-foot chain-link fencing along all at-grade, embankment, and trenched profile portions of the rail (excluding the areas noted in the next bullet)
- Fencing buried 3.5 feet at a 45-degree angle on the outside of the fence beneath the existing grade in the following locations: Alternative 2 between Stations B725 and B1075 (Coyote Valley) and Stations B1810 and B4310; Alternatives 1, 2, and 4 between Stations B2160 to B2350 (eastern Soap Lake and western Pacheco Pass); Alternative 3 between Stations B2040 and B2280 (eastern Soap Lake); and all alternatives between Station B31545 and B4310 (Pacheco Pass)
- Angled barbed wire at the top of chain-link fencing to prevent large animals from jumping over the fence and into the right-of-way in the following locations: Alternative 2 between Stations B725 and B1075 (Coyote Valley) and Stations B1810 and B4310; Alternatives 1, 2 and 4 between Stations B2160 to B2350 (eastern Soap Lake and western Pacheco Pass); Alternative 3 between Stations B2040 and B2280 (eastern Soap Lake); and all alternatives between Station B31545 and B5337 (Pacheco Pass and San Joaquin Valley)
- Fine-mesh (0.25- to 0.5-inch mesh size) fencing or other barrier designed to exclude small animals (e.g., California tiger salamander, Fresno kangaroo rat, blunt-nosed leopard lizard, and giant garter snake) and extending at least 2 feet aboveground and at least 6 to 10 inches below-ground with an overhanging 90-degree lip (minimum 6 inches) to prevent climbing in the following locations: Alternative 2 between Stations B840 and B960; Alternative 4 between Stations B800 and B900; all alternatives between Stations B3148 and B3223; and all alternatives between Station B4050 and Station B5337
- All gates designed to prevent animal access
- Jump out exit features that allow large mammals such as deer or mountain lion to exit the fenced right-of-way will be placed near at-grade road crossings in Coyote Valley at the following station numbers: B688, B691, B703, B730, B759, B761, B822, B823, B862, B863, B902, B935, B971, and B972
- Small, one-way exit flaps will be provided on each of the four fenced sections at each fence opening in Coyote Valley
- Prevent wildlife entry into the rail alignment at unfenced, at-grade rail sections using Rosehill anti-trespass panels or another method that has been shown to be effective for targeted focal species
- WEF, exit features, and exclusion devices will be inspected at least monthly to enforce proper function as described in the WCA (Authority 2020a: Appendix C).

The success of exclusion fencing and crossings deterrents to prohibit wildlife entry into the railway will be monitored, likely by cameras on the train, to determine effectiveness. If the deterrent is proven ineffective, and wildlife is gaining entry into the rail alignment with a frequency that is determined detrimental to rail function or wildlife populations, additional measures such as noise signals (an alarm sound that warns or scares the animal into leaving the location) or olfactory repellents will be implemented in the region of effect until wildlife entry into the right-of-way is effectively addressed.

Access roads and the associated curbs and drainage systems can, where constructed, pose barriers to movement and entrapment opportunities for small mammals, amphibians, and reptiles. To minimize the potential for these effects, drainage inlets associated with construction or access roads will be constructed with escape tubes or ladders as described in Appendix 3 of *Measures to*

Reduce Road Impacts on Amphibians and Reptiles in California: Best Management Practices and Technical Guidance (Langton and Clevenger 2021) when within 300 feet of occupied California red-legged frog aquatic habitat,1.24 miles of occupied California tiger salamander aquatic habitat, and 200 feet of occupied giant garter snake aquatic habitat. When and where curbs are needed, they should be angled or include escape gaps as described in *Guidelines for Amphibian and Reptile Conservation during Road Building and Management Activities in British Columbia* (Ministry of Environment and Climate Change Strategy 2020) when within the distances of occupied amphibian and reptile aquatic habitat described in the prior sentence.

BIO-MM#82: Minimize Permanent Intermittent Impacts on Aerial Species Wildlife Movement

To address the permanent intermittent impact of operations on aerial wildlife movement from train strike and entrapment, the Authority will implement an array of deterrent and diversion features for avian species. These features include the following, which are specified in detail in the WCA (Authority 2020a: Appendix C):

- Install pigeon wire or other features to discourage birds from perching on OCS throughout the project
- In selected areas, place flight barriers such as fencing, pole barriers or a tubular screen (Life Impacto Cero 2015) to the height of OCS to avoid birds flying into the rail alignment and being struck by the train in the following locations: Alternatives 1–3 between Stations B2270 and 2390 (near the San Jose International Airport); Alternative 4 between Stations B2872 and 2930 (near the San Jose International Airport); Alternatives 1, 2, and 4 between Stations B2164 and B2255 (eastern Soap Lake); Alternative 3 between Stations B2097 and B2185 (eastern Soap Lake); Alternatives 1, 2, and 4 between Stations B2340 and B3325 (western Pacheco Pass); Alternative 3 between Stations B2270+B3325 (western Pacheco Pass) and all alternatives between Stations B4035 and B4310 (eastern Pacheco Pass).
- Modify OCS poles to preclude bird entrapment in hollow poles (e.g., avoid the use of tubular poles or cap openings in all poles)
- Design aerial structures and tunnel portals to discourage bats from roosting in expansion joints or other crevices; light tunnel entrances

BIO-MM#83: Implement Removal of Carrion that May Attract Condors and Eagles

During operations in California condor and eagle foraging areas, automated security monitoring and track inspections will be used to detect fence failures or the presence of a carcass (carrion) within the right-of-way that could be an attractant to condors and eagles. Dead and injured wildlife found in the right-of-way will be removed when the train is not in operation. This measure will apply to Alternatives 1, 2, and 4 between Stations B2164 and B2255 (eastern Soap Lake); Alternative 3 between Stations B2097 and B2185 (eastern Soap Lake); Alternatives 1, 2, and 4 between Stations B2340 and B3325 (western Pacheco Pass); Alternative 3 between Stations B2270 and B3325 (western Pacheco Pass), and all alternatives between Stations B4035 and B4310 (eastern Pacheco Pass).

BIO-MM#84a: Avoid and Minimize Impacts on Conservation Areas

The Authority will coordinate with affected landowners or easement holders to determine if final project designs can be refined to avoid or minimize impacts on conservation areas (those areas held in fee title and/or held under conservation easements for the purposes of conservation). Examples may include minor design changes to HSR facilities that allow for continued access to all or part of a conservation area, changes that will facilitate effective placement of wildlife crossings, or other changes that minimize effects on other conservation work that has been completed or that is in progress on the conservation areas.

BIO-MM#84b: Provide Compensatory Mitigation for Impacts on Conservation Areas

The Authority will provide compensatory mitigation to offset impacts on conservation areas (those areas held in fee title and/or held under conservation easements for the purposes of conservation). Compensatory mitigation, identified through consultation with the affected

organizations, will replace the permanent loss of conservation areas with lands that are commensurate with the land cover type and ecological function of the lands lost at a ratio of 2:1 (protected:affected). In addition, the Authority will compensate affected organizations (e.g., The Nature Conservancy, SCVHA, SCVOSA, San Benito Land Trust, CDFW) for any incurred penalties (i.e., fees or other monetary considerations resulting from the termination of a conservation easement or establishment of a new conservation easement, as well as funding to offset staff time associated with identifying and protecting replacement sites) resulting from the permanent loss of a conservation area. Mitigation implemented under this measure will be consistent with and will help advance mitigation commitments at the program level, including mitigation intended to address impacts in the GEA.

Impacts from Implementing Mitigation Measure BIO-MM#84b

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#85: Provide Compensatory Mitigation for Impacts on California Sycamore Woodland at the Pacheco Creek Open Space Regional Reserve

To offset permanent impacts at the Pacheco Creek Open Space Regional Reserve and alleviate conflict with the SCVHP, the Authority will provide compensatory mitigation at a 1:1 ratio. The replacement reserve will be of the same acreage as the existing reserve (8.2 acres) or greater, and it will be primarily composed of a contiguous patch of the California sycamore alluvial woodland, the conservation target on which the reserve was formed. Mitigation lands can be co-located with the mitigation under BIO-MM#72 to meet the 10-acres minimum patch size requirement stipulated in Objective 9.2 of the SCVHP. This mitigation may be accomplished through preservation, enhancement, or restoration, or a combination thereof, with a preference given to mitigation opportunities in the Pajaro River HUC-8 watershed.

Impacts from Implementing Mitigation Measure BIO-MM#85

As addressed in the discussion of BIO-MM#10, compensatory mitigation could involve some secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#86: Provide Compensatory Mitigation for Impacts on Monarch Butterfly Habitat

To compensate for permanent impacts on monarch butterfly habitat (breeding and foraging habitat for the monarch butterfly), the Authority will provide compensatory mitigation at a minimum 1:1 ratio for occupied breeding and foraging habitat, unless a higher ratio is required by the FESA. The Authority, in accordance with authorizations issued under the FESA, will determine the compensatory mitigation required to offset impacts on habitat for monarch butterfly. Compensatory mitigation could include one or more of the following:

- Purchase of credits from an agency-approved conservation bank
- Acquisition in fee title of USFWS-approved property
- Purchase or establishment of a conservation easement with an endowment for long-term management of the property-specific conservation values
- An in-lieu fee contribution determined through negotiation and consultation with the USFWS
- Contribution to monarch conservation and/or restoration initiatives in the project region (if available)

Mitigation for monarch butterfly will prioritize areas with any future designated critical habitat (if the monarch is listed, and critical habitat is designated) and with existing monarch butterfly populations and suitable milkweed populations to support breeding. The secondary priority will be to create suitable habitat in other areas, if feasible (i.e., establish self-sustaining milkweed populations). The compensatory mitigation areas and methods selected will include appropriate measures to guide management of habitats (e.g., grazing, weed control), monitor populations, and identify methods to establish or reestablish populations, if necessary.

As described under BIO-MM#10, the Authority will prepare and implement an HMP that will include the considerations listed in this measure. The HMP will also set success criteria and define monitoring requirements so that species habitat can be adaptively managed.

As addressed in the discussion of BIO-MM#10, compensatory mitigation could result in secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts.

BIO-MM#87: Conduct Pre-Construction Surveys and Implement Avoidance and Minimization Measures for Mountain Lion Dens

Prior to any ground-disturbing activity, regardless of the time of year, the Project Biologist (a biologist with mountain lion experience and approved by CDFW) will conduct pre-construction surveys for *known* or *potential* mountain lion dens within suitable habitat located within the work area and within 1,970 feet of the work area (unless a different buffer distance is required under authorizations under the CESA). These surveys will be conducted no less than 14 days and no more than 30 days prior to the start of ground-disturbing activities in a work area. *Known* and *potential* mountain lion den types will be defined as follows (terminology generally consistent with the USFWS (2011) guidance for another mammal in the region, San Joaquin kit fox).

- **Known den**—Any existing natural den or human-made structure that is used or has been used at any time in the past by a mountain lion. Evidence of use may include historical records; past or current radio telemetry or tracking study data; mountain lion sign, such as tracks, scat, and/or prey remains; or other reasonable proof that a given den is being or has been used by a mountain lion.
- **Potential den**—Any thick vegetation, boulder piles, rocky outcrops, or undercut cliffs within the species' range for which available evidence is insufficient to conclude that it is being used or has been used by a mountain lion. Potential dens will include the following characteristics: (1) refuge from predators (coyotes, golden eagles, other mountain lions) or (2) shielding of the litter from heavy rain and hot sun.

The Project Biologist will use location-specific survey methods to identify known and potential dens. The survey method will consider topography, vegetation density, safety, and other factors. Surveys will be conducted by a qualified biologist (i.e., a biologist with demonstrated experience in mountain lion biology, identification, and survey techniques) and may involve the establishment of camera stations, scent stations, pedestrian surveys (looking for tracks, caches, etc.), the use of scent detection dogs, monitoring GPS collars (if available), or other appropriate methods as determined in coordination with CDFW. Survey methods used will be designed to avoid the disturbance of known or potential dens to the extent feasible.

If known or potential mountain lion dens are identified or observed during pre-construction surveys, mountain lion dens will be assumed to have kittens present until the Project Biologist can document that they are not present and/or that the den is not being used. A nondisturbance buffer of at least 1,970 feet will be established around the known or potential den until the Project Biologist can document and confirm that the den is not occupied. If the den is determined to be occupied, the 1,970-foot nondisturbance buffer will be maintained until the den is confirmed abandoned by the Project Biologist. Construction may proceed if the Project Biologist determines that the den is not being used by mountain lions.

BIO-MM#88: Provide Compensatory Mitigation for Impacts on Mountain Lion Habitat

The Authority will provide compensatory mitigation for impacts on mountain lion suitable habitat through the preservation of suitable habitat that is acceptable to CDFW. Habitat will be replaced at a minimum ratio of 2:1 for permanent impacts on breeding/foraging habitat and high-priority foraging and dispersal habitat and at a ratio of 1:1 for low-priority foraging and dispersal habitat, unless a higher ratio is required by regulatory authorizations issued under CESA. Compensatory mitigation will be provided using one or more of the methods described in BIO-MM#10 and will, where feasible and acceptable to CDFW, contribute to preserving important movement lands across the HSR alignment.

As addressed in the discussion of BIO-MM#10, compensatory mitigation could result in secondary impacts; however, these impacts would be beneficial, and the measures set forth in BIO-MM#11 would be implemented to minimize any adverse impacts. Overall, however, compensatory mitigation is expected to result in beneficial effects.

BIO-MM#89: Minimize the Impacts of Operational Lighting on Wildlife Species
To address the permanent and intermittent impacts from ALAN, the Authority will implement measures to minimize the intensity and duration of operational lighting of permanent facilities (e.g., traction power facilities, radio sites, and maintenance facilities), as well as intermittent train lighting, and will install noise/visual barriers at essential wildlife crossings to shield views of the operational train and its headlights. Outdoor lighting at operational facilities will be consistent with minimum OSHA requirements established by 29 C.F.R. Section 1926.56 when the facilities are in use. The Authority will minimize the duration of lighting at operational facilities by using methods other than lighting (e.g., remote monitoring systems) to ensure security of facilities during nighttime hours when they are not in use. Train headlights will use the minimum standard allowed by the FRA under 49 C.F.R. Section 229.125 (a single headlight of at least 200,000 candelas) within the following stationing limits (areas with low existing ALAN exposure):

- Alternative 1: B680 to B1000 (Coyote Valley) and B1810 to B5335 (areas east of Gilroy)
- Alternative 2: B720 to B1070 (Coyote Valley) and B1810 to B5335 (areas east of Gilroy)
- Alternative 3: B630 to B1000 (Coyote Valley) and B1450 to B5335 (areas east of Gilroy)
- Alternative 4: B670 to B1020 (Coyote Valley) and B1750 to B5335 (areas east of Gilroy)

If feasible (as determined through compliance with OSHA requirements and other applicable standards), as determined by the Authority, operational facilities, including trains, will use lighting that avoids shorter wavelengths of light (i.e., blue wavelengths). Lamps will have the lowest color temperature feasible for the desired application; green and red lighting appears to have the least wildlife impact and will be appropriate for some applications, such as security lighting (Longcore and Rich 2016; Kayumov et al. 2005).

3.7.9 Impact Summary for NEPA Comparison of Alternatives

Under NEPA, project effects are evaluated based on the criteria of context, intensity, and duration (short- or long-term). Impacts are identified and described according to the effects caused by the project after consideration of the project IAMFs and mitigation measures as identified in Sections 3.7.5.2 and 3.7.8. The effectiveness of measures to avoid, minimize, or mitigate impacts are considered in making significance determinations under NEPA. Thus, if a measure sufficiently mitigates an impact, the effect is not significant. Therefore, significance under NEPA is described as either an impact or no effect. General indicators of significance, based on guidelines or criteria in NEPA, CESA, FESA, and regulatory guidance from the FRA include:

- Potential modification or destruction of habitat; movement corridors; or breeding, feeding, and sheltering areas for endangered, threatened, rare, or other special-status species
- Potential measurable degradation of protected habitats, sensitive vegetation communities, wetlands, or other habitat areas identified in plans, policies, or regulations
- Potential loss of a substantial number of any species that could affect the abundance or diversity of that species beyond the level of normal variability
- Potential indirect impacts, both temporary and permanent, from excessive noise that elicits a negative response and avoidance behavior

Table 3.7-26 shows a comparison of project impacts by alternative, followed by a summary of the impacts. Impact acreages presented are a sum of the permanent and temporary impacts.

Table 3.7-26 Comparison of Project Alternative Impacts for Biological and Aquatic Resources (acres)

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Special-Status Species				
Impact BIO#1: Permanent Conversion or Degradation of Habitat for Special-Status Plant Species	The project would remove or disturb habitat for 54 special-status plant species, 8 of which are listed under the FESA or CESA, and could degrade habitat outside of but adjacent to the project footprint. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on special-status plants and their habitat under all alternatives.			
Habitat for all special-status plants (nonoverlapping)	1,639.4	1,673.0	1,658.3	1,583.3
Impact BIO#2a: Permanent Conversion or Degradation of Habitat for and Mortality of Bay Checkerspot Butterfly	The project would remove or disturb habitat (including critical habitat) for Bay checkerspot butterfly, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Increased shadows from construction of the viaduct in the Morgan Hill and Gilroy Subsection could alter flight behavior. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on Bay checkerspot butterfly under Alternative 1.	Impacts under Alternative 2 would be similar to Alternative 1 but would not have shadow impacts on flight behavior because it would be constructed on an embankment instead of viaduct. The area of affected habitat would be the same as Alternative 1.	Impacts under Alternative 3 would be similar to Alternative 1, but would affect slightly more habitat than Alternative 1.	Impacts under Alternative 4 would be similar to Alternative 1, but would affect less habitat.
Habitat for Bay checkerspot butterfly	32.4	42.5	32.4	25.4
Designated critical habitat for Bay checkerspot butterfly	26.0	34.8	26.0	21.0

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact BIO#2b: Permanent Conversion or Degradation of Habitat for and Mortality of Monarch Butterfly	The project would disturb or convert habitat for monarch butterfly and could degrade suitable habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on monarch butterfly under Alternative 1.	Impacts under Alternative 2 would be the same as under Alternative 1.	Impacts under Alternative 3 would be the same as under Alternative 1.	Impacts under Alternative 4 would be the same as under Alternative 1.
Habitat for monarch butterfly	5,345.8	5,606.8	5,548.8	5,092.3
Impact BIO#3: Permanent Conversion or Degradation of Habitat for and Mortality of Vernal Pool Crustaceans	The project would or disturb habitat for Conservancy fairy shrimp, longhorn fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp, and could degrade vernal pool habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on vernal pool crustaceans under all alternatives.			
Habitat for vernal pool fairy shrimp	27.6			
Habitat for vernal pool tadpole shrimp	27.6			
Habitat for longhorn fairy shrimp	27.6			
Habitat for Conservancy fairy shrimp	27.6			
Impact BIO#4: Removal or Pruning of Elderberry Plants Potentially Supporting Valley Elderberry Longhorn Beetle	The project may remove elderberry plants potentially occupied by valley elderberry longhorn beetle and could degrade habitat outside of but adjacent to the project footprint. Removal of occupied elderberry plants would result in mortality of individuals. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on valley elderberry longhorn beetle under all alternatives.			
Habitat potentially supporting valley elderberry longhorn beetle	158.9			

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact BIO#5: Permanent Conversion or Degradation of Habitat for and Mortality of Crotch Bumble Bee	The project would convert and disturb habitat and could result in the mortality of individual bees if underground nest colonies or overwintering queens are present in the project footprint at the time of construction. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on Crotch bumble bee under all alternatives.			
Habitat potentially supporting Crotch bumble bee	1,583.6	1,616.3	1,592.8	1,539.7
Impact BIO#6: Permanent Conversion of Habitat for and Direct Mortality of Steelhead and Pacific Lamprey, and Permanent Conversion of Essential Fish Habitat for Pacific Coast Salmon	The project would remove or disturb stream habitat for CCC and SCCC steelhead, Pacific lamprey, and designated EFH for Pacific Coast (Chinook and coho) salmon, and could degrade habitat downstream of the project footprint at affected stream crossings. Pile-driving and dewatering activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on special-status fish under all alternatives.			
Habitat for CCC/SCCC steelhead	34.0	36.1	46.8	31.1
Designated freshwater EFH for Pacific Coast salmon	9.8	10.2	9.8	6.6
Habitat for Pacific lamprey	207.4	213.1	212.6	200.5
Designated critical habitat for CCC/SCCC steelhead	8.2	9.4	9.4	7.5
Impact BIO#7: Permanent Conversion or Degradation of Habitat for and Direct Mortality of California Tiger Salamander	The project would remove or disturb habitat (including critical habitat) for California tiger salamander, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction, would minimize direct and indirect impacts on California tiger salamander under all alternatives.			
Habitat for California tiger salamander	3,159.7	3,392.7	3,404.3	2,968.6
Designated critical habitat for California tiger salamander	278.5			
Impact BIO#8: Permanent Conversion or Degradation of Habitat for and Direct Mortality of California Red-Legged Frog	The project would remove or disturb habitat (including critical habitat) for California red-legged frog, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on California red-legged frog under all alternatives.			
Habitat for California red-legged frog	2,837.6	3,333.5	3,001.6	2,469.7

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Designated critical habitat for California red-legged frog	923.6	923.6	923.0	923.6
Impact BIO#9: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Foothill Yellow-Legged Frog	The project would remove or disturb habitat for foothill yellow-legged frog, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on foothill yellow-legged frog under all alternatives.			
Habitat for foothill yellow-legged frog	133.0	131.2	132.9	127.7
Impact BIO#10: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Western Spadefoot	The project extent would remove or disturb habitat for western spadefoot, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on western spadefoot under all alternatives.			
Habitat for western spadefoot	740.8	740.8	760.9	740.8
Impact BIO#11: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Western Pond Turtle	The project would remove or disturb habitat for western pond turtle, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on western pond turtle under all alternatives.			
Habitat for western pond turtle	3,901.0	4,388.2	3,811.5	3,517.2
Impact BIO#12: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Blunt-Nosed Leopard Lizard	The project would remove or disturb habitat for blunt-nosed leopard lizard, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on blunt-nosed leopard lizard under all alternatives.			
Habitat for blunt-nosed leopard lizard	696.3			
Impact BIO#13: Permanent Conversion or Degradation of Habitat for and Direct Mortality of San Joaquin Coachwhip, Northern California Legless Lizard, and Coast Horned Lizard	The project would remove or disturb habitat for San Joaquin coachwhip, northern California legless lizard, and coast horned lizard, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on these species under all alternatives.			
Habitat for San Joaquin coachwhip	855.9	855.9	855.8	855.9
Habitat for northern California legless lizard	19.8	19.8	19.7	19.8

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Habitat for coast horned lizard	1,227.1	1,227.1	1,226.8	1,227.1
Impact BIO#14: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Giant Garter Snake	The project would remove or disturb habitat for giant garter snake, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on giant garter snake under all alternatives.			
Habitat for giant garter snake	568.0			
Impact BIO#15: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Short-Eared Owl and Grasshopper Sparrow	The project would remove or disturb habitat for short-eared owl and grasshopper sparrow, and could degrade habitat outside of but adjacent to the project footprint. Activities could also destroy or cause abandonment of active nests, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on these species under all alternatives.			
Habitat for short-eared owl	514.9			
Habitat for grasshopper sparrow	945.8	945.8	945.7	945.8
Impact BIO#16: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Mountain Plover and Western Snowy Plover (Interior Population)	The project would remove or disturb habitat for mountain plover, and could degrade habitat outside of but adjacent to the project footprint. Activities could also destroy or cause abandonment of active western snowy plover nests, if present in affected habitat, and disturb wintering mountain plovers. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on these species under all alternatives.			
Habitat for mountain plover	907.6			
Habitat for western snowy plover	35.1			
Impact BIO#17: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Burrowing Owl	The project would remove or disturb habitat for burrowing owl. Activities could also result in mortality of individuals by crushing occupied burrows or collapsing burrow entrances and preventing escape. Activities could also disturb nesting pairs and cause them to abandon eggs or young. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on burrowing owl under all alternatives.			
Habitat for burrowing owl	2,176.8	2,441.1	2,366.3	2,014.6
Impact BIO#18: Permanent Conversion or Degradation of Habitat for and Disturbance of Golden Eagle and Bald Eagle	The project would remove or disturb habitat for golden eagle and bald eagle. Activities within 0.5 mile of active nests could cause nesting pairs to abandon eggs or young. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct impacts on these species under all alternatives.			
Habitat for golden eagle	1,552.5	1,581.5	1,561.8	1,505.9
Habitat for bald eagle	536.8	548.8	526.6	515.7

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact BIO#19: Injury or Disturbance of California Condor	The project would be constructed at the edge of the California condor's range; however, individuals could fly over, forage, or land during construction activities. Construction debris and other materials could be ingested or cause entanglement. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct impacts on California condor under all alternatives.			
Impact BIO#20: Permanent Conversion or Degradation of Habitat for and Disturbance of Special-Status Raptors (American Peregrine Falcon, Northern Harrier, White-Tailed Kite) and Other Raptors	The project would remove or disturb habitat for American peregrine falcon, northern harrier, white-tailed kite, and other raptors. Activities within 500 feet of active nests could cause nesting pairs to abandon eggs or young. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct impacts on these species under all alternatives.			
Habitat for American peregrine falcon	4,594.7	5,287.7	4,682.6	4,012.5
Habitat for northern harrier	2,481.1	2,751.3	2,675.0	2,356.6
Habitat for white-tailed kite	3,218.4	3,478.5	3,412.9	2,971.9
Impact BIO#21: Permanent Conversion or Degradation of Habitat for and Disturbance of Swainson's Hawks	The project would remove or disturb habitat for Swainson's hawk. Activities within 0.5 mile of active nests could cause nesting pairs to abandon eggs or young. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct impacts on Swainson's hawk under all alternatives.			
Habitat for Swainson's hawk	1,534.4	1,743.5	1,534.4	1,480.8
Impact BIO#22: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Purple Martin, Olive-Sided Flycatcher, and Loggerhead Shrike	The project would remove or disturb habitat for purple martin, olive-sided flycatcher, and loggerhead shrike. Activities could also destroy or cause abandonment of active nests, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on these species under all alternatives.			
Habitat for loggerhead shrike	3,275.8	3,535.8	3,471.7	3,029.2
Habitat for purple martin	443.8	443.8	442.0	443.8
Habitat for olive-sided flycatcher	463.6	463.6	461.7	463.6
Impact BIO#23: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Least Bell's Vireo, Yellow Warbler, and Yellow-Breasted Chat	The project would remove or disturb habitat for least Bell's vireo, yellow warbler, and yellow-breasted chat, and could degrade habitat outside of but adjacent to the project footprint. Activities could also destroy or cause abandonment of active nests, if present in affected habitat. Construction BMPs, WEAP training, restoration and revegetation of disturbed areas, and invasive weed control measures will minimize direct and indirect impacts on these species under all alternatives.			
Habitat for least Bell's vireo	119.3	124.5	120.7	105.3

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Habitat for yellow warbler	54.2	55.1	53.5	45.3
Habitat for yellow-breasted chat	47.1	47.1	46.3	44.1
Impact BIO#24: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Tricolored Blackbird and Yellow-Headed Blackbird	The project would remove or disturb habitat for tricolored blackbird and yellow-headed blackbird, and could degrade habitat outside of but adjacent to the project footprint. Activities could also destroy or cause abandonment of active nests, if present in affected habitat. Construction BMPs, pre-construction nest surveys, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on these species under all alternatives.			
Habitat for tricolored blackbird	2,630.3	2,906.9	2,836.6	2,498.2
Habitat for yellow-headed blackbird	10.6			
Impact BIO#25: Permanent Conversion or Degradation of Habitat for and Disturbance of Sandhill Crane	The project would remove or disturb habitat for sandhill crane, and could degrade habitat outside of but adjacent to the project footprint. Activities could also disturb wintering sandhill cranes, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on sandhill crane under all alternatives.			
Habitat for greater sandhill crane	524.5			
Habitat for lesser sandhill crane	669.1			
Impact BIO#26a: Loss of Breeding, Foraging, and Dispersal Habitat for and Direct Mortality or Disturbance of Mountain Lion	The project would remove or disturb habitat for mountain lion and could degrade habitat outside of but adjacent to the project footprint. Construction activities could disrupt or prohibit the gene flow between mountain lion subpopulations. Activities could also result in mortality of individuals by crushing occupied dens and preventing escape. Activities could also disturb individuals and impair breeding, feeding, or sheltering behavior. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on mountain lion under all alternatives.			
Habitat for mountain lion	3,713.9	4,007.5	3,913.0	3,542.2
Impact BIO#26b: Loss of Denning and Dispersal Habitat for and Direct Mortality or Disturbance of San Joaquin Kit Fox	The project would remove or disturb habitat for San Joaquin kit fox, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals by crushing occupied burrows or collapsing burrow entrances and preventing escape. Activities could also disturb individuals and impair breeding, feeding, or sheltering behavior. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on San Joaquin kit fox under all alternatives.			
Habitat for San Joaquin kit fox	2,881.6	2,881.6	2,914.4	2,881.0
Impact BIO#27: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Fresno Kangaroo Rat	The project would remove or disturb habitat for Fresno kangaroo rat. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct impacts on Fresno kangaroo rat under all alternatives.			
Habitat for Fresno kangaroo rat	105.1			

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact BIO#28: Loss of Denning and Dispersal Habitat for and Direct Mortality or Disturbance of American Badger	The project would remove or disturb habitat for American badger, and could degrade habitat outside of but adjacent to the project footprint. Activities could also result in mortality of individuals by crushing occupied burrows or collapsing burrow entrances and preventing escape. Activities could also disturb individuals and impair breeding, feeding, or sheltering behavior. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on American badger under all alternatives.			
Habitat for American badger	1,173.1	1,204.7	1,178.5	1,129.1
Impact BIO#29: Permanent Conversion or Degradation of Habitat for and Direct Mortality of San Francisco Dusky-Footed Woodrat and Ringtail	The project would remove or disturb habitat for San Francisco dusky-footed woodrat and ringtail. Activities could also result in mortality of individuals, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct impacts on San Francisco dusky-footed woodrat and ringtail under all alternatives.			
Habitat for San Francisco dusky-footed woodrat and ringtail	502.4	512.8	513.3	479.9
Impact BIO#30: Loss of Roost Sites for and Direct Mortality or Disturbance of Special-Status Bats	The project would remove roosting habitat for pallid bat, Townsend's big-eared bat, western mastiff bat, and western red bat. Activities could also destroy or cause abandonment of occupied roost sites, if present in affected habitat. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct impacts on these species under all alternatives.			
Habitat for pallid bat	4,128.3	4,813.3	4,205.2	3,559.3
Habitat for Townsend's big-eared bat	2,120.9	2,370.4	2,318.0	1,850.5
Habitat for western mastiff bat	3,415.9	4,102.6	3,492.8	2,858.9
Habitat for western red bat	4,594.7	5,287.7	4,682.6	4,012.5
Impact BIO#31: Intermittent Disturbance or Degradation of Habitat for Special-Status Plants during Operations	O&M activities may occasionally remove or disturb and degrade habitat for special-status plants in and adjacent to the project footprint. Annual WEAP training for maintenance personnel would minimize intermittent direct and indirect impacts on special-status plants under Alternative 1.	Impacts under Alternative 2 would be the same as under Alternative 1. There are no special-status plant species or activity types unique to one alternative; all have the same potential to result in intermittent direct and indirect impacts.	Impacts under Alternative 3 would be the same as under Alternative 1. There are no special-status plant species or activity types unique to one alternative; all have the same potential to result in intermittent direct and indirect impacts.	Impacts under Alternative 4 would be the same as under Alternative 1. There are no special-status plant species or activity types unique to one alternative; all have the same potential to result in intermittent direct and indirect impacts.

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact BIO#32: Intermittent Disturbance or Degradation of Habitat for Special-Status Wildlife during Operations	O&M activities may occasionally remove or disturb habitat for special-status wildlife in and adjacent to the project footprint. Impacts would the same as during construction but would occur where activities were conducted in or adjacent to modeled habitat. Annual environmental awareness training for maintenance personnel would minimize intermittent direct and indirect impacts on special-status wildlife under Alternative 1. Operations effects on special-status wildlife individuals (i.e., injury or mortality) are addressed in the discussion of effects on wildlife movement.	Impacts under Alternative 2 would be the same as under Alternative 1. There are no special-status wildlife species or activity types unique to one alternative; all have the same potential to result in intermittent direct and indirect impacts.	Impacts under Alternative 3 would be the same as under Alternative 1. There are no special-status wildlife species or activity types unique to one alternative; all have the same potential to result in intermittent direct and indirect impacts.	Impacts under Alternative 4 would be the same as those under Alternative 2. There are no special-status wildlife species or activity types unique to one alternative; all have the same potential to result in intermittent direct and indirect impacts.
Non-Special-Status Wildlife				
Impact BIO#33: Mortality of Non-Special-Status Terrestrial Wildlife	The project could result in mortality of non-special-status terrestrial wildlife by crushing or mangling small ground-dwelling animals hidden underground or in dense vegetation, inadvertently releasing hazardous materials into aquatic habitat, or removing vegetation and structures that support non-special-status birds and bats. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct impacts on non-special-status wildlife under Alternative 1.	Impacts under Alternative 2 would be the same as under Alternative 1. There are no non-special-status wildlife species or activity types unique to one alternative; all have the same potential to result in direct impacts.	Impacts under Alternative 3 would be the same as under Alternative 1. There are no non-special-status wildlife species or activity types unique to one alternative; all have the same potential to result in direct impacts.	Impacts under Alternative 4 would be the same as under Alternative 1. There are no non-special-status wildlife species or activity types unique to one alternative; all have the same potential to result in direct impacts.

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact BIO#34: Removal or Degradation of Habitat for and Disturbance of Waterfowl and Shorebirds	The project would remove or disturb habitat for waterfowl and shorebirds in two Audubon IBAs, and could degrade habitat outside of but adjacent to the project footprint. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on waterfowl and shorebird habitat under Alternative 1.	Impacts under Alternative 2 would the same as under Alternative 1 because its footprint is identical where it crosses the Audubon IBAs.	Impacts under Alternative 3 would be similar to but greater than under Alternative 1 because Alternative 3 would cross more of the 10-year Soap Lake floodplain and agricultural lands east of Gilroy.	Impacts under Alternative 4 would the same as under Alternative 1 because its footprint is identical where it crosses the Audubon IBAs.
Special-Status Plant Communities				
Impact BIO#35: Permanent Conversion or Degradation of Special-Status Plant Communities	The project would remove or disturb the following special-status plant communities, and could degrade special-status plant communities adjacent to the project footprint. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on special-status plant communities under all alternatives.			
Alkali marsh	9.7			
Alkali scrub wetland	0.9			
Alkali vernal pool	27.1			
California annual grassland	1,138.4	1,166.4	1,144.0	1,091.9
California sycamore woodland	12.6			
Freshwater marsh	2.3	2.4	11.3	2.3
Mixed chaparral	19.6	19.6	19.5	19.6
Mixed riparian	26.3	27.6	30.3	20.9
Palustrine forested wetland	31.9	31.5	26.3	27.9
Seasonal wetland	16.2	16.4	13.9	11.6
Vernal pools	0.4			
Total area of special-status plant communities affected	1,269.4	1,299.0	1,281.3	1,209.9

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact BIO#36: Intermittent Disturbance Degradation of Special-Status Plant Communities during Operations	O&M activities may occasionally remove or disturb and degrade special-status plant communities in and adjacent to the project footprint. Annual environmental awareness training for maintenance personnel would minimize intermittent direct and indirect impacts on special-status plant communities under all alternatives.			
Aquatic Resources				
Impact BIO#37: Permanent Conversion or Degradation of Aquatic Resources Considered Jurisdictional under Section 404 of the Federal Clean Water Act or Regulated by the State	The project would remove or disturb federally protected wetland and nonwetland cover types (i.e., aquatic resources), and could degrade aquatic resources outside of but adjacent to the project footprint. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on aquatic resources under all alternatives.			
Wetlands	58.2 (P) 19.3 (T)	58.1 (P) 19.6 (T)	67.8 (P) 11.9 (T)	56.2 (P) 13.6 (T)
Nonwetlands	42.3 (P) 68.3 (T)	49.9 (P) 69.9 (T)	43.0 (P) 68.8 (T)	40.4 (P) 64.7 (T)
Total jurisdictional aquatic resources (permanent and temporary impacts total)	188.0	197.4	191.5	174.8
Impact BIO#38: Permanent Conversion or Degradation of Resources Regulated under California Fish and Game Code Section 1600 et seq.	The project would remove or disturb riparian habitat and aquatic resources subject to regulation under Section 1600 et seq., which may have a substantial adverse effect on fish and wildlife species. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on aquatic resources under all alternatives.			
Riparian habitat	55.1	56.1	54.5	46.4
Rivers, lakes, and streams	126.2	137.0	112.2	105.1
Total aquatic resources	181.3	193.1	166.7	151.5
Impact BIO#39: Intermittent Disturbance and Degradation of Aquatic Resources during Operations	O&M activities may occasionally remove or disturb and degrade aquatic resources in and adjacent to the project footprint. Annual environmental awareness training for maintenance personnel would minimize intermittent direct and indirect impacts on aquatic resources under all alternatives.			

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Protected Trees				
Impact BIO#40: Removal of Trees Protected under Municipal Tree Ordinances	The project may remove or prune trees protected under municipal tree ordinances. Ground disturbance could result in increased invasive weed cover that reduce the viability and regeneration of protected trees. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on protected trees under all alternatives.			
Impact BIO#41: Disturbance of Trees Protected under Municipal Tree Ordinances during Operations	Ongoing vegetation management within the electrical safety zone could result in temporary impacts (i.e., occasional trimming). Any protected trees requiring removal would have been removed during construction. The Authority would require that all workers attend WEAP training about sensitive biological resources, including protected trees.			
Wildlife Movement				
Impact BIO#42: Temporary Disruption of Wildlife and Wildlife Movement	The project would temporarily affect wildlife and wildlife movement by creating temporary barriers to movement (e.g., construction fencing and dewatering), creating noise and vibration that alters or delays animal movements as they attempt to avoid the work area, and introducing ALAN during nighttime construction that alters or delays animal movements as they avoid lit areas. The project could affect gene flow between subpopulations of mountain lions by temporarily precluding mountain lion movements. Wildlife exclusion fencing, and construction work windows would minimize temporary direct and indirect impacts on wildlife movement under all alternatives.	Impacts under Alternative 2 would be less than under Alternative 1 because Alternative 2 would stay within instead of circumvent downtown Morgan Hill, thus avoiding agricultural lands and staying farther from Coyote Creek, a known wildlife movement corridor. Alternative 2 would have the lowest temporary impact on wildlife movement of the four alternatives.	Impacts under Alternative 3 would be greater than those under Alternative 1 because Alternative 3 would cross more land protected to conserve wildlife movement and more of the Santa Cruz to Gabilan Range modeled wildlife corridor in the Soap Lake 10-year floodplain than the other alternatives. Alternative 3 would have the greatest temporary impact on wildlife movement of the four alternatives.	Impacts under Alternative 4 would be similar to those under Alternative 2.

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact BIO#43: Permanent Impacts on Wildlife Movement	The project would create a barrier to local and regional wildlife movement and fragment habitat. The project could affect the gene flow between subpopulations of mountain lions by precluding mountain lion movements. Dedicated wildlife crossings and modification of viaducts and drainage culverts to facilitate wildlife movement as proposed in the WCA would minimize permanent direct impacts on wildlife movement.	Impacts on terrestrial wildlife movement under Alternative 2 would be greater than under Alternative 1 because the alignment profile is at grade (rather than viaduct) through most portions of the Monterey Corridor and Morgan Hill and Gilroy Subsections, precluding the movement of several species.	Impacts under Alternative 3 would be greater than under Alternatives 1 and 2 because Alternative 3 would cross more of the Soap Lake floodplain and more undeveloped agricultural lands than these alternatives, and it would also result in more in-water impacts on aquatic species movement due to greater impacts on Llagas Creek.	Impacts under Alternative 4 would be similar to those under Alternative 2.
Impact BIO#44: Intermittent Nosie Disturbance of Wildlife Using Corridors during Operations	Noise from project operations could disturb and startle birds, particularly in the UPR and GEA IBAs, as well as cause varying degrees of hearing damage, leading to impacts on bioenergetic and reproductive success, as well as increasing the risk of train strike. Increasing the speeds from 200 mph to 220 mph in the Soap Lake area, as facilitated by the TDV, would increase the distances to the various effect thresholds for bird noise impacts. Additionally, noise would contribute to masking of acoustic information for terrestrial wildlife species, including mountain lion, Fresno kangaroo rat, and San Joaquin kit fox, leading to reduced habitat suitability.	Impacts under Alternative 2 would be the same as under Alternative 1 because both would have the same alignment and profile in the IBAs and within areas where terrestrial wildlife habitat is the most suitable.	Impacts under Alternative 3 would be greater than under the other alternatives because Alternative 3 would traverse more of the Soap Lake 10-year floodplain.	Impacts under Alternative 4 would be similar to but slightly greater than those under Alternatives 1 and 2 because of the presence of the MOWF at the edge of the Soap Lake 10-year floodplain.

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact BIO#45: Intermittent Vibration Disturbance of Wildlife Using Corridors during Operations	Vibration associate with project operations are likely to have the greatest impacts on reptiles and amphibians because of their sensitivity to ground movement; however, vibration is not anticipated to result in substantial or long-lasting impacts. The impact would be most pronounced in at-grade portions of the alignment.	Impacts under Alternative 2 would be greater than those under Alternatives 1 and 3 because more of the alignment would be at grade.	Impacts under Alternative 3 would be similar to but greater than those under Alternative 1 because, while Alternative 3 would be on aerial structure in many of the same areas as Alternative 1, it would also cross more land conserved to protect movement corridors, including the Santa Cruz Mountains to Diablo Range wildlife linkage.	Impacts under Alternative 4 would be similar to those under Alternative 2 because of their similar use of at-grade and embankment profiles.
Impact BIO#46: Intermittent Visual Disturbance of Wildlife Using Corridors during Operations	Moving trains could alter movement patterns of mammalian species due to visual stimuli associated with passing trains or maintenance activities. Moving trains may also cause visual cues, which cause animals to temporarily or permanently avoid an area. Moving trains could also increase stress and provoke flight in birds using nearby habitat, resulting in altered behavior and physiological consequences, as well as possible nest abandonment. The GEA and the Soap Lake 10-year floodplain are the two areas most susceptible to these impacts.	Impacts under Alternative 2 would be the same as those under Alternative 1.	Impacts under Alternative 3 would be greater than those under the other three alternatives because it would traverse more of the Soap Lake 10-year floodplain.	Impacts under Alternative 4 would be the same as those under Alternatives 1 and 2.

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact BIO#47: Intermittent and Permanent Lighting Disturbance of Wildlife and Wildlife Using Corridors during Operations	Nighttime lighting, including light from passing trains, could disturb wildlife attempting to move through or across the alignment. The impact would be most marked in areas with low existing light levels, especially where the alignment would be at grade.	Impacts under Alternative 2 would be similar to those under Alternative 1. Although more of Alternative 2 would be at grade, these portions would be in existing transportation corridors where light levels are already high.	Impacts under Alternative 3 would be greater than under the other three alternatives because it would cross agricultural areas east of Gilroy at grade, would cross more of the Santa Cruz Mountains to Diablo Range wildlife linkage, and would include the East Gilroy MOWF and Station in areas that currently experience low light levels.	Impacts under Alternative 4 would be the same as those under Alternative 2.
Impact BIO#48: Mortality Resulting from Train Strike during Operations	Train strike is likeliest to cause mortality of terrestrial wildlife species along at-grade portions of the alignment. Alternative 1 would pose the lowest risk of train strike to terrestrial movement guilds because of the amount that would be on aerial structure. All profiles present risk of train strike to the aerial movement guild, although some focal groups are more susceptible to at-grade profiles, while others are more susceptible to elevated portions of the alignment.	Impacts under Alternative 2 would be greater than those under Alternative 1 because of the amount of the alignment at grade and on embankment.	Alternative 3 would present the greatest risk of train strike because, while much of it, like Alternative 1, would be on aerial structure, it would also cross through agricultural lands east of Gilroy at grade and would travel more closely to Coyote Creek than the other alternatives.	Impacts under Alternative 4 would be the same as those under Alternative 2.
Impact BIO#49: Injury and Mortality Resulting from Power Line Strike during Operations	Risk of power line strike would be ubiquitous along the alignment because of the consistent presence of electrical infrastructure. Alternative 1 could pose a greater risk to burrowing owls at San Jose International Airport, and would follow Coyote Creek for a greater distance than Alternatives 2 and 4.	Impacts under Alternative 2 would be similar to those under Alternative 1, except that there would be lesser risk to burrowing owls near the San Jose International Airport.	Impacts under Alternative 3 would be similar, although the distribution of the most severe risks would differ: Alternative 3 would cross less of the UPR IBA, although more of that distance would be in the Soap Lake 10-year floodplain, the area of most intensive bird use.	Impacts under Alternative 4 would be the same as those under Alternative 2.

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact BIO#50: Mortality resulting from Entrapment in OCS Poles during Operations	The project is expected to avoid direct impacts from entrapment in OCS poles by design features that will preclude access to the poles.			
Conservation Areas				
Impact BIO#51: Permanent Conversion or Degradation of Conservation Areas	The project would remove or disturb conservation area lands, and could degrade conservation area lands outside of but adjacent to the project footprint. Construction BMPs, WEAP training, and biological monitoring during construction would minimize direct and indirect impacts on jurisdictional aquatic resources under all alternatives.			
Acres of conservation areas affected	535.8	564.8	595.7	539.0
Number of conservation areas affected	11	14	11	9
Impact BIO#52: Introduction of Invasive Species or Contaminants into Conservation Areas during Operations	The project could have indirect impacts on conservation areas in all subsections. Routine inspections and maintenance of the HSR right-of-way could introduce contaminants from spills and invasive nonnative species to adjacent lands, degrading habitat for special-status species, special-status plant communities, aquatic resources, and wildlife corridors. All project alternatives would be similar in their potential to cause these impacts; however, Alternative 3 would result in the most permanent impacts and, by extrapolation, the most indirect impacts during the operations period.			
Habitat Conservation Plans				
Impact BIO#53: Conflict with Santa Clara Valley Habitat Plan	The project could conflict with the following conservation actions of the SCVHP: ▪ Action LAND-L4 requires the acquisition and enhancement of natural and semi-natural landscapes between the Santa Teresa Hills and Metcalf Canyon to the south that will contribute to providing connectivity between the Santa Cruz Mountains and Diablo Range to promote the movement of covered and other native species at many spatial scales. ▪ Action LAND-WP7 requires the acquisition of habitat near Santa Teresa Hills and Tulare Hill to provide connectivity between populations in the Diablo Range and the Santa Cruz foothills. ▪ Action LAND-R3 requires the acquisition in fee title of or obtaining conservation easements on lands that protect at least 40 acres of existing California sycamore woodland so that this very rare and threatened land cover type is preserved in the study area. Potential conflicts with Actions LAND-L4 and LAND-WP7 are not expected in that the project would not interfere with land acquisition because the project alternatives would be located in areas outside the areas identified for acquisition. There would be a potential conflict with Action LAND-R3 because the SCVHA is in the process of obtaining a conservation easement to protect California sycamore woodland along Pacheco Creek at the Pacheco Creek Open Space Regional Reserve, and the project would have permanent and temporary direct impacts within the area targeted for protection.			

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact BIO#54: Conflict with Santa Clara Valley Greenprint	The project would not conflict with the Santa Clara Valley Greenprint. Strategy 3 of the Greenprint includes the goal of protecting and maintaining connections between large open-space parcels to provide large habitat blocks, critical linkages, and climate resilience. The project would cross three of ten conservation focus areas identified under Strategy 3: Coyote Valley, Upper Pajaro River, and Coyote Creek. However, the Greenprint does not identify quantitative goals or strategies for these areas. In addition, Alternative 3 would affect protected parcels identified by the Greenprint as important for agricultural land protection (Bloomfield North and Bloomfield South easements), but these parcels are not included in its habitat conservation goals. Since the project (all alternatives) would not prevent the successful implementation of any Greenprint strategy, and since the project would not preclude implementation of the Greenprint in any of the conservation focus areas that would be affected by the project (all alternatives), nor would the impacts on conservation parcels result in a substantial impact on Greenprint implementation, the project alternatives would not conflict with implementation of the Greenprint.			
Impact BIO#55: Conflict with Coyote Valley Linkage	Construction of the project alternatives would result in potential conflicts with two recommended wildlife crossing modifications proposed under the Coyote Valley Linkage: a wildlife overpass at Metcalf Canyon Road or at Bailey Road and a wildlife undercrossing at Blanchard Road. HSR would not prohibit implementation of the Coyote Valley Linkage Plan under any alternative; however, it would increase the complexity of construction and incrementally increase the length of the proposed crossings (except under Alternative 4).			

ALAN = artificial light at night
FESA = federal Endangered Species Act
CESA = California Endangered Species Act
BMP = best management practice
WEAP = worker environmental awareness program
CCC = central California coast
SCCC = south-central California coast
EFH = essential fish habitat
O&M = operations and maintenance
IBA = Important Bird Area
WCA = Wildlife Corridor Assessment
UPR = Upper Pajaro River
GEA = Grasslands Ecological Area
MOWF = maintenance of way facility
OCS = overhead contact system
HSR = high-speed rail
SCVHP = Santa Clara Valley Habitat Plan
SCVHA = Santa Clara Valley Habitat Agency
mph = miles per hour
TDV = tunnel design variant

[1] The alkali vernal pool type includes areas mapped as vernal pool complexes. Acreage provided is an estimate of the wetted vernal pool area within vernal pool complexes.

3.7.9.1 Special-Status Species

Special-Status Plants

Construction of the project alternatives would have direct and indirect impacts on habitat for special-status plant species and individual special-status plant occurrences, if any are present in affected habitat. The primary project activities affecting special-status plant habitat would be HSR right-of-way, TCEs, and utility easements. Additional effects on aquatic special-status plants may result from groundwater reduction during tunnel construction and the resultant disruption of hydrologic cycles of surface water resources and/or affected to protected trees. Work to construct Tunnels 1 and 2 would affect the greatest area of special-status plant habitat due to the extent of undeveloped native plant communities at the portal sites (e.g., chaparral, oak woodland, California sycamore woodland). All project alternatives would be nearly identical with respect to the number of species potentially affected. Alternative 3 would affect habitat for one additional species. Alternatives 1, 3, and 4 would have slightly less permanent and temporary impacts on state- and federally listed species, in terms of acres affected, than Alternative 2. Project operations would be conducted in areas that would have already been subjected to extensive ground disturbance and construction activities. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#7, BIO-MM#8, BIO-MM#9, BIO-MM#10, BIO-MM#11, and BIO-MM#12 are available to reduce this impact.

Bay Checkerspot Butterfly

Construction of the project alternatives would cause direct (permanent and temporary) and indirect impacts on habitat for Bay checkerspot butterfly (including critical habitat) and could cause direct impacts on individuals (i.e., injury, mortality, or disturbance), if any are present in affected habitat. Impacts would occur where modeled habitat and designated critical habitat are present in or adjacent to the project footprint. Under Alternatives 1 and 3, shadows cast by the viaduct onto butterfly habitat in the Morgan Hill and Gilroy Subsection could alter flight behavior of Bay checkerspot butterflies. Because Alternative 2 would be constructed on an embankment instead of viaduct and Alternative 4 would use the existing Caltrain and UPRR right-of-way, they would not result in shadow impacts on flight behavior. Alternative 2 would affect a greater area of Bay checkerspot butterfly habitat and critical habitat because it would entail a larger footprint in the Tulare Hill area. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#10, BIO-MM#13, BIO-MM#14, BIO-MM#15, and BIO-MM#16 are available to reduce this impact.

Monarch Butterfly

Construction of the project alternatives would cause direct (permanent and temporary) and indirect impacts on habitat for monarch butterfly and could cause direct impacts on individuals (i.e., injury, mortality, or disturbance), if any are present in affected habitat. Additional effects on monarch nectar plants (shrubs and trees only) may result from groundwater depletion during tunnel construction and the resultant disruption of hydrologic cycles of surface water resources. Impacts would occur where modeled suitable habitat is present in or adjacent to the project footprint. Impacts under all alternatives are generally similar because the species can occur in a wide variety of habitats and has a wide distribution. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#10, BIO-MM#13, BIO-MM#14, and BIO-MM#86 are available to reduce this impact.

Vernal Pool Crustaceans

Construction of the project alternatives may have direct and indirect impacts on Conservancy fairy shrimp, longhorn fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp habitat and on individuals if any are present in affected habitat. The primary project activities affecting vernal pool crustaceans would be HSR right-of-way, maintenance access easements, new culverts, traction power infrastructure, utility easements, and other ground-disturbing activities that occur within vernal pools and improvements that would alter the hydroperiod of vernal pools. Such activities could lead to conversion of vernal pool habitat to HSR track and systems, direct mortality of individuals and cysts through crushing by construction equipment, and

alteration of hydrology that supports vernal pool ecosystems. All project alternatives would have the same impacts on these species, including acreage of affected habitat, because the alternatives would be identical in the subsections where modeled habitat occurs. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#10, BIO-MM#13, BIO-MM#17, BIO-MM#18, BIO-MM#19, and BIO-MM#20 are available to reduce this impact.

Valley Elderberry Longhorn Beetle

Construction of the project alternatives may have direct and indirect impacts on valley elderberry longhorn beetle habitat and on individual beetles if any are present in affected habitat. The primary project activities affecting valley elderberry longhorn beetle would be HSR right-of-way, maintenance access easements, new culverts, traction power infrastructure, utility easements, and other ground-disturbing activities within riparian land cover, activities removing elderberry shrubs, and improvements that would alter the local topography or hydrologic regime that could result in reduced fitness or death of the host plant. Because of its dependence on the host plant, loss of occupied host plants and individuals could extirpate a population or cause it eventually to reach a point where it cannot persist. All project alternatives would have the same impacts on valley elderberry longhorn beetle, including acreage of affected habitat, because the alternatives would be identical in the subsections where modeled habitat occurs. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#11, BIO-MM#13, BIO-MM#21, and BIO-MM#22 are available to reduce this impact.

Crotch's Bumble Bee

Construction of the project alternatives may have direct and indirect impacts on Crotch's bumble bee through ground-disturbing activities, which would convert and disturb habitat and could result in the mortality of individual bees if underground nest colonies or overwintering queens are present in the project footprint at the time of construction. Alternative 2 would result in the greatest extent of potential impacts, primary because of the ground disturbance involved in the embankment profile. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#12, BIO-MM#23, and BIO-MM#24 are available to reduce this impact.

Special-Status Fish

Construction of the project alternatives may have direct and indirect impacts on special-status fish, if any are present in affected habitat, and on their habitat (including designated critical habitat for CCC and SCCC steelhead and Chinook and coho salmon EFH). The primary project activities affecting special-status fish would be HSR right-of-way (including bridge and viaduct construction and channel realignment), TCE, utility easement, bike lane/pedestrian bridge, and new culverts. Additional effects on steelhead may result from groundwater reduction during tunnel construction and the associated disruption of hydrologic cycles of steelhead-bearing streams. All project alternatives would have the same types of impacts on special-status fish and their habitat at affected stream crossings, but the number of affected crossings (and therefore amount of affected habitat) would slightly vary among alternatives. Alternative 2 would affect a greater amount of modeled habitat and designated critical habitat for CCC steelhead than Alternatives 1, 3, and 4 due to the addition of TCEs over Llagas Creek in the Morgan Hill and Gilroy Subsection. Alternative 3 would permanently affect a greater amount of designated critical habitat for SCCC steelhead than Alternatives 1, 2, and 4 due to additional crossings of the Pajaro River and Llagas Creek in the Morgan Hill and Gilroy Subsection. BIO-MM#1, BIO-MM#3, BIO-MM#4, BIO-MM#6, BIO-MM#9, BIO-MM#10, BIO-MM#13, BIO-MM#25, BIO-MM#26, BIO-MM#27a, BIO-MM#27b, BIO-MM#27c, and BIO-MM#28 are available to reduce this impact.

California Tiger Salamander

Construction of the project alternatives would have both permanent and temporary direct and indirect impacts on California tiger salamander habitat (including critical habitat) and on individuals, if any are present in affected habitat. The primary project activities affecting California tiger salamander habitat and critical habitat would be HSR right-of-way, access easements, roadway right-of-way (permanent), TCE, underground easement, and utility easement. Additional effects on California tiger salamander may result from groundwater reduction during tunnels

construction and the associated disruption of hydrologic cycles of surface water resources. All project alternatives would have broadly similar impacts on this species, with differences in area of affected habitat, because the portions of the project alternatives that overlap with modeled habitat have identical footprints. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#9, BIO-MM#10, BIO-MM#13, BIO-MM#29, BIO-MM#30, and BIO-MM#31 are available to reduce this impact.

California Red-Legged Frog

Construction of the project alternatives would have direct and indirect impacts on California red-legged frog habitat (including critical habitat) and on individuals, if any are present in affected habitat. The primary project activities affecting California red-legged frog habitat and critical habitat would be access easement, HSR right-of-way, roadway right-of-way (permanent), underground easement, utility easement, and TCE. Additional effects on California red-legged frog may result from groundwater reduction during tunnel construction and the associated disruption of hydrologic cycles of surface water resources. All project alternatives would have broadly similar impacts on this species, with differences in area of affected habitat. Most portions of the project alternatives that overlap with modeled habitat have identical footprints. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#9, BIO-MM#10, BIO-MM#13, BIO-MM#32, and BIO-MM#33 are available to reduce this impact.

Foothill Yellow-Legged Frog

Construction of the project alternatives would have direct and indirect impacts on foothill yellow-legged frog habitat and on individuals, if any are present in affected habitat. The primary project activities affecting foothill yellow-legged frog habitat would be HSR right-of-way, underground easement, and TCE. Additional effects on foothill yellow-legged frog may result from groundwater reduction during tunnel construction and the associated disruption of hydrologic cycles of surface water resources. All project alternatives would have similar impacts on this species, with minor differences in area of affected habitat, because the portions of the alternatives that overlap with modeled habitat have identical footprints. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#9, BIO-MM#10, BIO-MM#13, BIO-MM#34, and BIO-MM#35 are available to reduce this impact.

Western Spadefoot

Construction of the project alternatives would have direct and indirect impacts on western spadefoot habitat and on individuals, if any are present in affected habitat. The primary permanent direct impact would be conversion of habitat (which may or may not be occupied at the time of construction) to HSR track and systems. Permanent direct impacts on western spadefoot habitat and individuals would include removal of aquatic breeding habitat; terrestrial cover and aestivation habitat; and vernal pool complex breeding, cover, and aestivation habitat. All project alternatives would have similar impacts on this species, with minor differences in the extent of affected habitat. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#9, BIO-MM#13, BIO-MM#36, and BIO-MM#37 are available to reduce this impact.

Western Pond Turtle

Construction of the project alternatives would have direct and indirect impacts on western pond turtle habitat and on individuals, if any are present in affected habitat. The primary project activities affecting western pond turtle habitat would be access easement, HSR right-of-way, roadway right-of-way (permanent), underground easement, utility easement, and TCE. Additional effects on western pond turtle may result from groundwater reduction during tunnel construction and the associated disruption of hydrologic cycles of surface water resources. All project alternatives would have broadly similar impacts on this species, with differences in the extent of affected habitat, because the portions of the alternatives that overlap with modeled habitat have identical footprints. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#9, BIO-MM#13, BIO-MM#36, and BIO-MM#37 are available to reduce this impact.

Blunt-Nosed Leopard Lizard

Construction of the project alternatives would have direct and indirect impacts on blunt-nosed leopard lizard habitat and on individuals, if any are present in affected habitat. The primary project activities affecting blunt-nosed leopard lizard habitat would be access easement, HSR right-of-way, and utility easement. All project alternatives would have identical impacts on this species because the portions of the alternatives that overlap with suitable habitat have identical footprints. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#10, BIO-MM#13, BIO-MM#38, and BIO-MM#40 are available to reduce this impact. BIO-MM#39 will avoid direct impacts on individuals (i.e., take of a California fully protected species).

San Joaquin Coachwhip, Northern California Legless Lizard, and Coast Horned Lizard

Construction of the project alternatives would have direct and indirect impacts on suitable habitat for San Joaquin coachwhip, northern California legless lizard, and coast horned lizard and may have impacts on individuals, if any are present in affected habitat. The project activities affecting habitat for these three species would be HSR right-of-way, TCE, and underground easement. Work to construct Tunnels 1 and 2 would have the largest impacts on San Joaquin coachwhip and coast horned lizard habitat; work to construction Tunnel 1 and the west Portal of Tunnel 2 would have the largest impacts on northern California legless lizard habitat. All project alternatives would have identical impacts on these species because the portions of the alternatives that overlap with suitable habitat have identical footprints. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#13, BIO-MM#36, and BIO-MM#37 are available to reduce this impact.

Giant Garter Snake

Construction of the project alternatives would have direct and indirect impacts on giant garter snake habitat and on individuals, if any are present in affected habitat. The primary project activities affecting habitat for giant garter snake would be HSR right-of-way, maintenance access easements, new culverts, traction power infrastructure, and utility easements. All project alternatives would have identical impacts on giant garter snake because the portions of the alternatives that overlap with suitable habitat have identical footprints. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#10, BIO-MM#13, BIO-MM#41, and BIO-MM#42 are available to reduce impact.

Short-Eared Owl and Grasshopper Sparrow

Construction of the project alternatives would have direct and indirect impacts on habitat for short-eared owl and grasshopper sparrow and may have impacts on individuals, if any are present in affected habitat. The project activities affecting habitat for short-eared owl and grasshopper sparrow would be access easements, automatic train control (ATC) sites, communication radio antennas, HSR right-of-way, staging areas, traction power infrastructure, underground easements, and utility easements. All project alternatives would have identical impacts on these species because the portions of the alternatives that overlap with suitable habitat have identical footprints. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#13, and BIO-MM#43 are available to reduce this impact.

Mountain Plover and Snowy Plover

Construction of the project alternatives would have direct and indirect impacts on habitat for mountain plover and western snowy plover (interior population) and may have impacts on snowy plover individuals, if any are present in affected habitat. The project activities affecting habitat for mountain plover and western snowy plover would be access easements, ATC sites, communication radio antenna, HSR right-of-way, HSR maintenance stations, roadway right-of-way (permanent and temporary), traction power infrastructure, and utility easements. All project alternatives would have identical impacts on these species because the portions of the alternatives that overlap with suitable habitat have identical footprints. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#13, BIO-MM#43, and BIO-MM#44 are available to reduce this impact.

Burrowing Owl

Construction of the project alternatives would have direct and direct impacts on habitat for burrowing owl and may have impacts on individuals, if any are present in affected habitat. The project activities affecting habitat for burrowing owl would be HSR right-of-way, maintenance access easements, new culverts, traction power infrastructure, and utility easements. All project alternatives would have identical impacts on this species in the Pacheco Pass and San Joaquin Valley Subsections because the portions of the alternatives that overlap with suitable habitat have identical footprints. Alternatives 2 and 3 would have similar impacts on suitable habitat in the remaining subsections. Alternative 1 would affect a similar amount of habitat as Alternatives 2 and 3 in the San Jose Diridon Station Approach and Monterey Corridor Subsections, but less habitat in the Morgan Hill and Gilroy Subsection because of the increased extent of viaduct that would result in less ground disturbance. Alternative 4 would affect the least amount of habitat because of its reduced footprint. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#10, BIO-MM#13, BIO-MM#45, BIO-MM#46, and BIO-MM#47 are available to reduce this impact.

Golden Eagles and Bald Eagles

Construction of the project alternatives would have direct impacts on habitat for bald and golden eagles and may have impacts on individuals, if any are present in affected habitat. The project activities affecting habitat for these species would be access easements, ATC sites, communication radio antennas, high-voltage line construction access road, HSR right-of-way, HSR stations/maintenance facilities, network upgrades, new culverts, roadway right-of-way (temporary and permanent), staging areas, traction power infrastructure, underground easements, and utility easements. The project alternatives would have similar impacts on these species, with minor differences in the acreage of affected habitat. BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#13, BIO-MM#48, and BIO-MM#50 are available to reduce this impact. BIO-MM#49 will avoid direct impacts on individuals (i.e., take of California fully protected species).

California Condor

Construction of the project alternatives could have direct impacts on California condor individuals, if any are present within construction areas. Project activities could introduce construction materials which could entangle birds, or introduce construction fluids or other materials which could be ingested by birds causing injury. The project alternatives would have similar impacts on California condor. BIO-MM#5, BIO-MM#6, BIO-MM#13, and BIO-MM#51 will avoid direct impacts on individual California condors (i.e., take of California fully protected species).

Raptors

Construction of the project alternatives would have direct impacts on habitat for raptors and may have direct impacts on individuals, if any are present in affected habitat. All project activities could potentially affect habitat for raptors because nesting habitat is present throughout the entire habitat study area. All project alternatives would have broadly similar impacts on these species, with differences in the extent of affected habitat for the three special-status raptor species (American peregrine falcon, northern harrier, and white-tailed kite). BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#13, and BIO-MM#52 are available to reduce this impact.

Swainson's Hawk

Construction of the project alternatives would have direct impacts on nesting and foraging habitat for Swainson's hawk and may have direct impacts on individuals, if any are present in affected nesting habitat. The project activities affecting habitat for Swainson's hawk would be ATC sites, communication radio antenna, access easements, HSR right-of-way, HSR stations/maintenance facilities, network upgrades, non-HSR TCEs, roadway right-of-way (permanent and temporary), staging areas, traction power infrastructure, underground easements, and utility easements. Alternatives 1 and 3 would have identical impacts on this species because the portions of the alternatives that overlap with suitable habitat have identical footprints. Alternative 2 would affect

more acres of foraging habitat than Alternatives 1, 3, and 4 because Alternative 2 would cross more agricultural land cover in the Monterey Corridor and Morgan Hill and Gilroy Subsections than the other three alternatives. BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#10, BIO-MM#13, BIO-MM#53, BIO-MM#54, and BIO-MM#55 are available to reduce this impact.

Purple Martin, Olive-Sided Flycatcher, and Loggerhead Shrike

Construction of the project alternatives would have direct impacts on habitat for purple martin, olive-sided flycatcher, and loggerhead shrike and may have impacts on individuals, if any are present in affected habitat. The primary project activities affecting habitat for purple martin and olive-sided flycatcher would be HSR right-of-way within the Morgan Hill and Gilroy and Pacheco Pass Subsections. All project activities would affect habitat for loggerhead shrike. All alternatives would have similar impacts on these species, with minor differences in the acreage of affected habitat. BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#13, and BIO-MM#43 are available to reduce this impact.

Special-Status Riparian Birds

Construction of the project alternatives would have direct and indirect impacts on habitat for special-status riparian birds (i.e., least Bell's vireo, yellow warbler, and yellow-breasted chat) and may have impacts on individuals, if any are present in affected habitat. The primary project activities affecting special-status riparian birds would be HSR right-of-way, access easements, new culverts, and underground easement. Additional effects on riparian birds may result from groundwater inflows into tunnels during construction and the associated disruption of hydrologic cycles of surface water resources. All alternatives would have broadly similar impacts on these species, with differences in the acreage of affected habitat. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#9, BIO-MM#13, and BIO-MM#43 are available to reduce this impact.

Tricolored Blackbird and Yellow-Headed Blackbird

Construction of the project alternatives would have direct impacts on habitat for tricolored blackbird and yellow-headed blackbird, and may have impacts on individuals, if any are present in affected habitat. The project activities affecting tricolored blackbird and yellow-headed blackbird would be access easements, HSR right-of-way, and TCEs; all project activities could affect tricolored blackbird. Additional effects on tricolored blackbird and yellow-headed blackbird may result from groundwater inflows into tunnels during construction and the associated disruption of hydrologic cycles of surface water resources. The alternatives would have slightly different impacts on suitable habitat for tricolored blackbird, ranging from approximately 2,900 acres under Alternative 2 to approximately 2,500 acres under Alternative 4. All project alternatives would have the same impacts on yellow-headed blackbird, including acreage of affected habitat, because the portions of the alternatives that overlap with modeled habitat have identical footprints. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#9, BIO-MM#10, BIO-MM#13, BIO-MM#56, and BIO-MM#57 are available to reduce this impact.

Sandhill Crane

Construction of the project alternatives would have direct and indirect impacts on habitat for greater and lesser sandhill crane and direct impacts (i.e., disturbance) on individuals, if any are present. The primary project activities affecting habitat for sandhill crane would be access easements, ATC sites, communication radio antenna, HSR right-of-way, HSR maintenance stations, roadway right-of-way (permanent and temporary), traction power infrastructure, and utility easements. All project alternatives would have identical impacts on this species because the portions of the alternatives that overlap with suitable habitat in the San Joaquin Valley Subsection have identical footprints. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#10, BIO-MM#13, BIO-MM#44, and BIO-MM#58 are available to reduce this impact.

Mountain Lion

Construction of the project alternatives would have direct and indirect impacts on suitable habitat for mountain lion and on individuals, if any are present in affected habitat. The primary project activities affecting mountain lion habitat would be HSR right-of-way, TCE, and underground easement. All project alternatives would have nearly identical impacts on this species because the portions of the alternatives that overlap with suitable habitat in the Pacheco Pass and San Joaquin Valley Subsections have identical footprints. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#10, BIO-MM#13, BIO-MM#79a, BIO-MM#87, and BIO-MM#88 are available to reduce this impact.

San Joaquin Kit Fox

Construction of the project alternatives would have direct and indirect impacts on San Joaquin kit fox habitat and on individuals, if any are present in affected habitat. The primary project activities affecting San Joaquin kit fox habitat would be HSR right-of-way, TCE, and underground easement. All project alternatives would have nearly identical impacts on this species because the portions of the alternatives that overlap with suitable habitat in the Pacheco Pass and San Joaquin Valley Subsections have identical footprints. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#10, BIO-MM#13, BIO-MM#59, BIO-MM#60, and BIO-MM#61 are available to reduce this impact.

Fresno Kangaroo Rat

Construction of the project alternatives would have direct impacts on habitat for Fresno kangaroo rat and may have impacts on individuals, if any are present in affected habitat. The project activities affecting habitat for Fresno kangaroo rat would be limited to the project footprint east of I-5 and would primarily include HSR right-of-way. All project alternatives would have identical impacts on this species because the portions of the alternatives that overlap with suitable habitat in the San Joaquin Valley Subsection have identical footprints. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#10, BIO-MM#13, BIO-MM#62, and BIO-MM#63 are available to reduce this impact.

American Badger

Construction of the project alternatives would have direct and indirect impacts on American badger habitat and on individuals, if any are present in affected habitat. The primary project activities affecting American badger habitat would be HSR right-of-way, TCE, underground easement, and utility easement. All project alternatives would have similar impacts on this species, with minor differences in area of affected habitat, because the portions of the alternatives that overlap with modeled habitat have nearly identical footprints. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#13, and BIO-MM#64 are available to reduce this impact.

San Francisco Dusky-Footed Woodrat and Ringtail

Construction of the project would have direct and indirect impacts on habitat for San Francisco dusky-footed woodrat and ringtail and may have impacts on individuals, if any are present in affected habitat. The primary project activity affecting habitat for San Francisco dusky-footed woodrat and ringtail would be HSR right-of-way. All project alternatives would have similar impacts on these species, with minor differences in acreage of affected habitat, because the portions of the alternatives that overlap with modeled habitat have nearly identical footprints. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#13, BIO-MM#65, and BIO-MM#66 are available to reduce this impact. BIO-MM#62 will avoid direct impacts on individual ringtails (i.e., take of a California fully protected species).

Special-Status Bats

Construction of the project would have direct impacts on roosting habitat for special-status bats and may have impacts on individuals, if any are present in affected habitat. The primary project activity affecting habitat for special-status bats would be HSR right-of-way. The project

alternatives would have similar impacts on this species, with differences in acreage (in descending order, Alternatives 2, 3, 1, and 4) ranging from approximately 5,700 acres to 4,400 acres. BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#13, BIO-MM#67, BIO-MM#68, and BIO-MM#69 are available to reduce this impact.

3.7.9.2 Non-Special-Status Wildlife

Construction of the project alternatives would involve construction activities that could result in mortality of non-special-status terrestrial wildlife. Heavy equipment (e.g., excavator, bulldozer) could crush or mangle small, ground-dwelling amphibians (e.g., Sierran treefrog), reptiles (e.g., common garter snake), or mammals (e.g., western harvest mouse) hidden underground or in dense herbaceous cover during ground disturbance, and vehicle traffic on dirt roads could crush burrows occupied by such animals. Inadvertent release of hazardous materials (e.g., oils, fluids) into aquatic habitat during construction could cause mortality of amphibians and reptiles through dermal contact or absorption. Vegetation removal and structure modification or demolition activities could cause mortality of non-special-status birds and bats. This permanent direct impact could occur throughout the project extent because all terrestrial wildlife species (not just special-status species limited to specific land cover types) could potentially be affected. Project features to avoid or minimize impacts on special-status wildlife will also address impacts on non-special-status wildlife.

Construction of the project alternatives would result in temporary and permanent impacts on wetland and open-water habitat for waterfowl and shorebirds. Although habitat for waterfowl and shorebirds occurs in limited amounts throughout the project extent, the highest concentration of these important bird habitats (and hence the occurrence of these species) has been documented in the GEA and UPR (Soap Lake) Audubon IBAs. Additional effects on riparian species may result from groundwater inflows into tunnels during construction and the associated disruption of hydrologic cycles of surface water resources. Alternative 3 would have slightly greater temporary impacts on these habitats than Alternatives 1 and 2 and slightly lesser permanent impacts. Operations of the project would introduce new noise sources to the GEA and UPR Audubon IBAs. Noise that adds to ambient noise can possibly affect birds through several mechanisms; however, because the noise from passing trains would be intermittent and not continuous, it would not substantially contribute to masking biologically important sounds (e.g., vocal signals of other birds) with human-generated noise. All project alternatives would generate abrupt, infrequent, loud noises that together with the sight of fast-approaching trains could increase stress or change bird behavior. Increasing the speeds from 200 mph to 220 mph in the Soap Lake area, as facilitated by the TDV, would increase the distances to the various effect thresholds for bird noise impacts. This direct, intermittent impact would be the same for all project alternatives because they all pass through both Audubon IBAs. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#43, and BIO-MM#58 are available to reduce this impact.

3.7.9.3 Special-Status Plant Communities

Construction activities within the project footprint would have direct impacts on special-status plant communities. These impacts would include removal or disruption (i.e., trampling and crushing) of special-status plant communities by construction vehicles and personnel. With respect to vegetation removal, it should be noted that vegetation within the HSR right-of-way would be permanently removed. Additional effects on riparian or aquatic special-status plant communities may result from groundwater reduction during tunnel construction and the associated disruption of hydrologic cycles of surface water resources and/or affect protected trees. The project alternatives would have identical impacts on alkali marsh, alkali scrub wetland, alkali vernal pool, vernal pool, California sycamore woodland, and mixed chaparral cover types supporting special-status plant communities because the portions of the alternatives that overlap with these cover types have identical footprints; impacts on most other communities would be broadly similar across alternatives, although Alternative 3 would result in the greatest effect on mixed riparian. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-

MM#7, BIO-MM#9, BIO-MM#71, BIO-MM#72, BIO-MM#73, and BIO-MM#74 are available to reduce this impact.

3.7.9.4 Aquatic Resources

Construction of the project alternatives would have direct and indirect impacts on aquatic resources. Construction of those portions of the project extent that cross or abut aquatic resources could result in placement of fill (e.g., for construction of bridge supports), installation of culverts, and associated in-channel work. Construction of track and systems could also alter surface and subsurface hydrology that supplies or drains aquatic features. Additional effects on aquatic resources may result from groundwater reduction during tunnel construction and the associated disruption of hydrologic cycles of surface water resources. All four project alternatives would affect a generally similar amount of aquatic resources; however, Alternative 2 would have slightly greater impacts than Alternatives 1, 3, and 4. Alternative 4 would have lesser impacts than Alternatives 1, 2, and 3. BIO-MM#1, BIO-MM#2, BIO-MM#3, BIO-MM#4, BIO-MM#5, BIO-MM#6, BIO-MM#9, BIO-MM#25, BIO-MM#71, BIO-MM#72, BIO-MM#73, and BIO-MM#74 are available to reduce this impact.

3.7.9.5 Protected Trees

Construction of the project would have direct and indirect impacts on trees protected under local ordinances through removal (permanent) and trimming or root disruption (temporary). The primary indirect impact would be habitat degradation from increased cover of nonnative invasive plants. All three project alternatives would affect a similar areal extent of land cover types potentially supporting protected trees. Additional effects on protected trees may result from groundwater reduction during tunnel construction. BIO-MM#9 and BIO-MM#75 are available to reduce this impact.

3.7.9.6 Wildlife Movement

Construction of the project alternatives would have temporary, permanent, and intermittent permanent impacts on wildlife corridors and movement from noise, visual changes, and ALAN. Impacts would occur where wildlife movement is known or likely to occur across or near the project footprint. Temporary impacts during construction (when all construction areas would be fenced) would be greatest under Alternative 3, which bisects agricultural lands east of Gilroy. Additional effects on fish movement may result from groundwater inflows into tunnels during construction and the associated disruption of hydrologic cycles of streams. Alternative 4 would have the least impact because it would make use of the existing UPRR right-of-way and would thus require a smaller project footprint. Alternative 1 would avoid impacts east of Gilroy, but it would have the same impacts as Alternative 3 in the area east of Morgan Hill. Permanent impacts would be greatest under Alternative 2, which would be primarily at grade or on embankment through the Morgan Hill and Gilroy Subsection, creating an almost complete barrier to east-west wildlife movement across the Santa Clara Valley, whereas Alternatives 1 and 3 would be on viaduct in this subsection. Alternative 3 would have greater impacts than Alternative 1 because it would be at grade or on embankment across agricultural areas east of Gilroy, it would bisect protected lands in the Soap Lake floodplain, and it would cross more of the Santa Cruz to Gabilan critical linkage. Intermittent permanent impacts (i.e., operations impacts—primarily train strike) would vary both by location and by species movement guild. Alternative 2 would have the greatest impacts on terrestrial species because of its at-grade or embankment profiles in the Morgan Hill and Gilroy Subsection. Alternative 1 would have the greatest impact on burrowing owls because it would be at grade near the San Jose International Airport, where a breeding colony of burrowing owls is known to be persist. Alternatives 1 and 3 would have the greatest impact on riparian birds because those alternatives would follow more of the Coyote Creek corridor than Alternative 2. Alternative 3 would pose the greatest hazard for waterfowl and shorebirds because it passes closer to the Soap Lake 10-year floodplain than the other three alternatives. Under all alternatives, carrion on or near the right-of-way could attract eagles and California condors, resulting in a potential for train strike to occur. Under all alternatives, noise effects on wildlife would occur, resulting in potential behavioral changes, primarily to avian species but also to terrestrial wildlife species (primarily mammals).

With respect to mountain lion, the inclusion of dedicated crossings and viaducts in the project design are expected to facilitate the continued gene flow between subpopulations; however, some uncertainty exists around this conclusion because the movement of mountain lions and thresholds for movement are not well understood. Consequently, impacts causing disruptions to genetic flow between subpopulations are possible. BIO-MM#3, BIO-MM#76a, BIO-MM#76b, BIO-MM#77a, BIO-MM#77b, BIO-MM#78, BIO-MM#79a, BIO-MM#80, BIO-MM#81, BIO-MM#82, and BIO-MM#83 are available to reduce this impact.

3.7.9.7 Conservation Areas

Construction of the project would have direct and indirect impacts on conservation areas. The primary project activities affecting conservation areas would be HSR right-of-way, TCE, and utility easement. Additional effects on water resources in conservation areas over the tunnel alignment may result from groundwater reduction during tunnel construction and the associated disruption of hydrologic cycles of surface water resources. All project alternatives would have identical impacts on Romero Ranch Conservation Easement and on the Pacheco Creek Open Space Regional Reserve because all alternatives have identical footprints in those areas. All project alternatives would have similar impacts on lands within the Soap Lake region, and Alternatives 1 and 2 would be identical; however, Alternative 3 would have greater permanent impacts. The remaining major difference between project alternatives is that Alternative 3 would have a permanent impact on the Bloomfield Conservation Area, while Alternatives 1 and 2 would have no permanent impacts on this area. The difference between the impacts on all other conservation areas would be minor by acres and number of conservation areas affected. BIO-MM#9, BIO-MM#10, BIO-MM#84a. and BIO-MM#84b are available to reduce this impact.

3.7.9.8 Habitat Conservation Plans

Construction of the project alternatives would result in potential impacts on three HCPs: the SCVHP, the Greenprint, and the Coyote Valley Linkage. The SCVHP is an adopted federal HCP and NCCP prepared pursuant to Section 10 of the FESA and NCCPA, respectively. The Greenprint and Coyote Valley Linkage are approved regional or local HCPs. The project alternatives could have impacts on habitat connectivity under the SCVHP between the Santa Cruz Mountains and the Diablo Range by potentially limiting or affecting the movement of species between these regions. Additionally, the alternatives would have permanent and temporary impacts in a particular area targeted for protection; consequently, additional lands would need to be secured to meet the objectives of that identified acquisition action. All four alternatives would have identical impacts. BIO-MM#79a, BIO-MM#84a, BIO-MM#84b, and BIO-MM#85 are available to further reduce this impact.

The project alternatives could also have impacts on wildlife crossings proposed under the Coyote Valley Linkage, primarily by increasing the length of proposed crossings and increasing the engineering complexity and associated cost of implementing the crossings. BIO-MM#77a and BIO-MM#79a are available to reduce this impact.

3.7.10 CEQA Significance Conclusions

As described in Section 3.1.5.4, the impacts of project actions under CEQA are evaluated against thresholds to determine whether a project action would result in no impact, a less-than-significant impact, or a significant impact. Table 3.7-27 shows the CEQA significance determinations for each impact discussed in Section 3.7.7.

Under all four alternatives, nearly all construction-related impacts on biological and aquatic resources would be significant before mitigation. Permanent and temporary construction impacts would result from removal or disturbance of multiple land cover types that provide habitat for native plants and animals (including special-status species). Some land cover types are also designated as aquatic resources or special-status plant communities; impacts on these resources would be significant under all four alternatives. Significant impacts on special-status wildlife would also occur where HSR track and systems cross known wildlife corridors and Audubon IBAs.

Table 3.7-27 CEQA Significance Conclusions and Mitigation Measures for Biological and Aquatic Resources

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Special-Status Species			
Impact BIO#1: Permanent Conversion or Degradation of Habitat for Special-Status Plant Species	Significant for all alternatives: Construction of the project would remove or disturb habitat for special-status plant species and could degrade habitat outside of but adjacent to the work areas.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#7: Conduct Botanical Surveys for Special-Status Plant Species and Special-Status Plant Communities BIO-MM#8: Prepare and Implement Plan for Salvage, Relocation, and/or Propagation of Special-Status Plant Species BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#11: Implement Measures to Minimize Impacts During Off-Site Habitat Restoration, or Enhancement, or Creation on Mitigation Sites BIO-MM#12: Provide Compensatory Mitigation for Impacts on Listed Plant Species	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#2a: Permanent Conversion or Degradation of Habitat for and Mortality of Bay Checkerspot Butterfly	Significant for all alternatives: Construction of the project would remove or disturb habitat (including critical habitat) for Bay checkerspot butterfly and could degrade habitat outside of but adjacent to the work areas. Activities could also result in mortality of individuals, if present in affected habitat. Increased shadows from construction of the viaduct the Morgan Hill and Gilroy Subsection could alter flight behavior.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#14: Avoid Direct Impacts on Bay Checkerspot and Monarch Butterfly Host Plants BIO-MM#15: Prepare and Implement Bay Checkerspot Butterfly Protection Plan BIO-MM#16: Provide Compensatory Mitigation for Impacts on Bay Checkerspot Butterfly Habitat	Less than Significant
Impact BIO#2b: Permanent Conversion or Degradation of Habitat for and Mortality of Monarch Butterfly	Significant for all alternatives: Construction of the project would remove or disturb habitat for monarch butterfly and could degrade habitat outside of but adjacent to the work areas. Activities could also result in mortality of individuals, if present in affected habitat.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Adaptive Management and Monitoring Plan BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#14: Avoid Direct Impacts on Bay Checkerspot and Monarch Butterfly Host Plants BIO-MM#86: Provide Compensatory Mitigation for Impacts on Monarch Butterfly Habitat	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#3: Permanent Conversion or Degradation of Habitat for and Mortality of Vernal Pool Crustaceans	Significant for all alternatives: Construction of the project would remove or disturb habitat for vernal pool crustaceans and could degrade habitat outside of but adjacent to the work areas. Activities could also result in mortality of individuals, if present in affected habitat.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#17: Conduct Pre-Construction Surveys for Vernal Pool Wildlife Species BIO-MM#18: Implement Seasonal Vernal Pool Work Restriction BIO-MM#19: Implement and Monitor Vernal Pool Avoidance Minimization Measures within Temporary Impact Areas BIO-MM#20: Provide Compensatory Mitigation for Impacts on Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp Habitat	Less than Significant
Impact BIO#4: Removal or Pruning of Elderberry Plants Potentially Supporting Valley Elderberry Longhorn Beetle	Significant for all alternatives: The project may remove elderberry plants potentially occupied by valley elderberry longhorn beetle, and could degrade habitat outside of but adjacent to the work areas. Removal of occupied elderberry plants would result in mortality of individuals.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#11: Implement Measures to Minimize Impacts During Off-Site Habitat Restoration, or Enhancement, or Creation on Mitigation Sites BIO-MM#13: Implement Work Stoppage BIO-MM#21: Implement Avoidance Measures for Elderberry Shrubs outside Permanent Impact Areas BIO-MM#22: Provide Compensatory Mitigation for Impacts on Valley Elderberry Longhorn Beetle Habitat	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#5: Permanent Conversion or Degradation of Habitat for and Mortality of Crotch's Bumble Bee	Significant for all alternatives: The project would convert and disturb habitat and could result in the mortality of individual bees if underground nest colonies or overwintering queens are present in the project footprint at the time of construction.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#12: Provide Compensatory Mitigation for Impacts on Listed Plant Species BIO-MM#23: Conduct Surveys and Implement Avoidance Measures for Crotch's Bumble Bee BIO-MM#24: Provide Compensatory Mitigation for Impacts on Crotch's Bumble Bee	Less than Significant
Impact BIO#6: Permanent Conversion of Habitat for and Direct Mortality of Steelhead and Pacific Lamprey, and Permanent Conversion of Essential Fish Habitat for Pacific Coast Salmon	Significant for all alternatives: The project would remove or disturb stream habitat for CCC and SCCC steelhead, Pacific lamprey, and Pacific Coast salmon EFH, and could degrade habitat downstream of the work areas at affected stream crossings. Pile-driving and dewatering activities could also result in mortality of individuals, if present in affected habitat.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#25: Prepare Plan for Dewatering and Water Diversions BIO-MM#26: Prepare and Implement a Fish Rescue Plan BIO-MM#27a: Implement General Protection Measures for Fish BIO-MM#27b: Work Windows for Fish BIO-MM#27c: Prepare and Implement an Underwater Sound Control Plan BIO-MM#28: Provide Compensatory Mitigation for Permanent Impacts on Steelhead Habitat and Essential Fish Habitat for Pacific Coast Salmon	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#7: Permanent Conversion or Degradation of Habitat for and Direct Mortality of California Tiger Salamander	Significant for all alternatives: The project would remove or disturb habitat (including critical habitat) for California tiger salamander, and could degrade habitat outside of but adjacent to the work areas. Activities could also result in mortality of individuals, if present in affected habitat.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#29: Conduct Pre-Construction Surveys for California Tiger Salamander BIO-MM#30: Implement Avoidance and Minimization Measures for California Tiger Salamander BIO-MM#31: Provide Compensatory Mitigation for Impacts on California Tiger Salamander Habitat	Less than Significant
Impact BIO#8: Permanent Conversion or Degradation of Habitat for and Direct Mortality of California Red-Legged Frog	Significant for all alternatives: The project would remove or disturb habitat (including critical habitat) for California red-legged frog, and could degrade habitat outside of but adjacent to the work areas. Activities could also result in mortality of individuals, if present in affected habitat.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#32: Conduct Pre-Construction Surveys and Implement Avoidance and Minimization Measures for California Red-Legged Frog BIO-MM#33: Provide Compensatory Mitigation for Impacts on California Red-Legged Frog Habitat	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#9: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Foothill Yellow-Legged Frog	Significant for all alternatives: The project would remove or disturb habitat for foothill yellow-legged frog, and could degrade habitat outside of but adjacent to the work areas. Activities could also result in mortality of individuals, if present in affected habitat.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#34: Conduct Pre-construction Surveys and Implement Avoidance and Minimization Measures for Foothill Yellow-Legged Frog BIO-MM#35: Provide Compensatory Mitigation for Impacts on Foothill Yellow-Legged Frog Habitat	Less than Significant
Impact BIO#10: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Western Spadefoot	Significant for all alternatives: The project would remove or disturb habitat for western spadefoot, and could degrade habitat outside of but adjacent to the work areas. Activities could also result in mortality of individuals, if present in affected habitat.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#13: Implement Work Stoppage BIO-MM#36: Conduct Pre-Construction Surveys for Special-Status Reptiles and Amphibians BIO-MM#37: Implement Avoidance and Minimization Measures for Special-Status Reptiles and Amphibians	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#11: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Western Pond Turtle	Significant for all alternatives: The project would remove or disturb habitat for western pond turtle, and could degrade habitat outside of but adjacent to the work areas. Activities could also result in mortality of individuals, if present in affected habitat.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#13: Implement Work Stoppage BIO-MM#36: Conduct Pre-Construction Surveys for Special-Status Reptiles and Amphibians BIO-MM#37: Implement Avoidance and Minimization Measures for Special-Status Reptiles and Amphibians	Less than Significant
Impact BIO#12: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Blunt-Nosed Leopard Lizard	Significant for all alternatives: The project would remove or disturb habitat for blunt-nosed leopard lizard, and could degrade habitat outside of but adjacent to the work areas. Activities could also result in mortality of individuals, if present in affected habitat.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#38: Conduct Surveys for Blunt-Nosed Leopard Lizard BIO-MM#39: Implement Avoidance Measures for Blunt-Nosed Leopard Lizard BIO-MM#40: Provide Compensatory Mitigation for Impacts on Blunt-Nosed Leopard Lizard Habitat	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#13: Permanent Conversion or Degradation of Habitat for and Direct Mortality of San Joaquin Coachwhip, Northern California Legless Lizard, and Coast Horned Lizard	Significant for all alternatives: The project would remove or disturb habitat for San Joaquin coachwhip, northern California legless lizard, and coast horned lizard, and could degrade habitat outside of but adjacent to the work areas. Activities could also result in mortality of individuals, if present in affected habitat.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#36: Conduct Pre-Construction Surveys for Special-Status Reptiles and Amphibians BIO-MM#37: Implement Avoidance and Minimization Measures for Special-Status Reptiles and Amphibians	Less than Significant
Impact BIO#14: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Giant Garter Snake	Significant for all alternatives: The project would remove or disturb habitat for giant garter snake, and could degrade habitat outside of but adjacent to the work areas. Activities could also result in mortality of individuals, if present in affected habitat.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#41: Conduct Pre-Construction Surveys and Implement Avoidance and Minimization Measures for Giant Garter Snake BIO-MM#42: Provide Compensatory Mitigation for Impacts on Giant Garter Snake Habitat	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#15: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Short-Eared Owl and Grasshopper Sparrow	Significant for all alternatives: The project would remove or disturb habitat for short-eared owl and grasshopper sparrow, and could degrade habitat outside of but adjacent to the work areas. Activities could also destroy or cause abandonment of active nests, if present in affected habitat.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#43: Conduct Pre-Construction Surveys and Delineate Active Nest Buffers for Breeding Birds	Less than Significant
Impact BIO#16: Permanent Conversion or Degradation of Habitat for Mountain Plover and Disturbance of Western Snowy Plover (Interior Population)	Significant for all alternatives: The project would remove or disturb habitat for mountain plover, and could degrade habitat outside of but adjacent to the work areas. Activities could also destroy or cause abandonment of active western snowy plover nests, if present in affected habitat, and disturb wintering mountain plovers.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#43: Conduct Pre-Construction Surveys and Delineate Active Nest Buffers for Breeding Birds BIO-MM#44: Implement Avoidance and Minimization Measures for Mountain Plover and Sandhill Crane	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#17: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Burrowing Owl	Significant for all alternatives: The project would remove or disturb habitat for burrowing owl. Activities could also result in mortality of individuals by crushing occupied burrows or collapsing burrow entrances and preventing escape. Activities could also disturb nesting pairs and cause them to abandon eggs or young.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#45: Conduct Surveys for Burrowing Owl BIO-MM#46: Implement Avoidance and Minimization Measures for Burrowing Owl BIO-MM#47: Provide Compensatory Mitigation for Loss of Active Burrowing Owl Burrows and Habitat	Less than Significant
Impact BIO#18: Permanent Conversion or Degradation of Habitat for and Disturbance of Golden Eagle and Bald Eagle	Significant for all alternatives: The project would remove or disturb habitat for golden eagle and bald eagle. Activities within 0.5 mile of active nests could cause nesting pairs to abandon eggs or young.	BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#48: Conduct Pre-Construction Surveys for Eagles BIO-MM#49: Implement Avoidance Measures for Active Eagle Nests BIO-MM#50: Provide Compensatory Mitigation for Loss of Eagle Nests	Less than Significant
Impact BIO#19: Injury or Disturbance of California Condor	Significant for all alternatives. The project could affect California condor through entrapment in construction materials or ingestion of fluids or other materials causing injury.	BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#51: Implement Avoidance Measures for California Condor	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#20: Permanent Conversion or Degradation of Habitat for and Disturbance of Special-Status Raptors (American Peregrine Falcon, Northern Harrier, White-Tailed Kite) and Other Raptors	Significant for all alternatives: The project would remove or disturb habitat for American peregrine falcon, northern harrier, white-tailed kite, and other raptors. Activities within 1,000 feet of active nests could cause nesting pairs to abandon eggs or young.	BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#52: Conduct Pre-Construction Surveys and Monitoring for Raptors	Less than Significant
Impact BIO#21: Permanent Conversion or Degradation of Habitat for and Disturbance of Swainson's Hawks	Significant for all alternatives: The project would remove or disturb habitat for Swainson's hawk. Activities within 1,320 feet of active nests could cause nesting pairs to abandon eggs or young.	BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#53: Conduct Surveys for Swainson's Hawks Nests BIO-MM#54: Implement Avoidance and Minimization Measures for Swainson's Hawk Nests BIO-MM#55: Provide Compensatory Mitigation for Loss of Swainson's Hawk Nesting Trees and Habitat	Less than Significant
Impact BIO#22: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Purple Martin, Olive-Sided Flycatcher, and Loggerhead Shrike	Significant for all alternatives: The project would remove or disturb habitat for purple martin, olive-sided flycatcher, and loggerhead shrike. Activities could also destroy or cause abandonment of active nests, if present in affected habitat.	BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#43: Conduct Pre-Construction Surveys and Delineate Active Nest Buffers for Breeding Birds	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#23: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Least Bell's Vireo, Yellow Warbler, and Yellow-Breasted Chat	Significant for all alternatives: The project would remove or disturb habitat for least Bell's vireo, yellow warbler, and yellow-breasted chat, and could degrade habitat outside of but adjacent to the work areas. Activities could also destroy or cause abandonment of active nests, if present in affected habitat.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#13: Implement Work Stoppage BIO-MM#43: Conduct Pre-Construction Surveys and Delineate Active Nest Buffers for Breeding Birds BIO-MM#72: Provide Compensatory Mitigation for Permanent Impacts on Riparian Habitat	Less than Significant
Impact BIO#24: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Tricolored Blackbird and Yellow-Headed Blackbird	Significant for all alternatives: The project would remove or disturb habitat for tricolored blackbird and yellow-headed blackbird, and could degrade habitat outside of but adjacent to the work areas. Activities could also destroy or cause abandonment of active nests, if present in affected habitat.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Plan BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#56: Conduct Surveys and Implement Avoidance Measures for Active Tricolored Blackbird Nest Colonies BIO-MM#57: Provide Compensatory Mitigation for Impacts on Tricolored Blackbird Habitat	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#25: Permanent Conversion or Degradation of Habitat for and Disturbance of Sandhill Crane	Significant for all alternatives: The project would remove or disturb habitat for sandhill crane, and could degrade habitat outside of but adjacent to the work areas. Activities could also disturb wintering sandhill cranes, if present in affected habitat.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#44: Avoid or Minimize Disturbance on Mountain Plover and Sandhill Crane BIO-MM#58: Provide Compensatory Mitigation for Impacts on Waterfowl, Shorebird, and Sandhill Crane Habitat	Less than Significant
Impact BIO#26a: Loss of Breeding, Foraging, and Dispersal Habitat for and Direct Mortality or Disturbance of Mountain Lion	Significant for all alternatives: The project would remove or disturb habitat for mountain lion, potentially disrupting breeding, foraging, or dispersal and could degrade habitat outside of but adjacent to the work areas.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#87: Conduct Pre-Construction Surveys and Implement Avoidance and Minimization Measures for Mountain Lion Dens BIO-MM#88: Provide Compensatory Mitigation for Impacts on Mountain Lion Habitat	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#26b: Loss of Denning and Dispersal Habitat for and Direct Mortality or Disturbance of San Joaquin Kit Fox	Significant for all alternatives: The project would remove or disturb habitat for San Joaquin kit fox, and could degrade habitat outside of but adjacent to the work areas. Activities could also result in mortality of individuals by crushing occupied burrows or collapsing burrow entrances and preventing escape. Activities could also disturb individuals and impair breeding, feeding, and sheltering behavior.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#59: Conduct Pre-Construction Surveys for San Joaquin Kit Fox BIO-MM#60: Implement San Joaquin Kit Fox Avoidance and Minimization Measures BIO-MM#61: Provide Compensatory Mitigation for Impacts on San Joaquin Kit Fox Habitat	Less than Significant
Impact BIO#27: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Fresno Kangaroo Rat	Significant for all alternatives: The project would remove or disturb habitat for Fresno kangaroo rat. Activities could also result in mortality of individuals, if present in affected habitat.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#13: Implement Work Stoppage BIO-MM#62: Implement Avoidance and Minimization Measures for Fresno Kangaroo Rat BIO-MM#63: Provide Compensatory Mitigation for Impacts on Fresno Kangaroo Rat Habitat	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#28: Permanent Conversion or Degradation of Habitat for and Direct Mortality of American Badger	Significant for all alternatives: The project would remove or disturb habitat for American badger, and could degrade habitat outside of but adjacent to the work areas. Activities could also result in mortality of individuals by crushing occupied burrows or collapsing burrow entrances and preventing escape. Activities could also disturb individuals and impair breeding, feeding, or sheltering behavior.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#64: Conduct Pre-Construction Surveys for American Badger Den Sites and Implement Avoidance and Minimization Measures	Less than Significant
Impact BIO#29: Permanent Conversion or Degradation of Habitat for and Direct Mortality of San Francisco Dusky-Footed Woodrat and Ringtail	Significant for all alternatives: The project would remove or disturb habitat for San Francisco dusky-footed woodrat and ringtail. Activities could also result in mortality of individuals, if present in affected habitat.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#65: Conduct Pre-Construction Surveys for Ringtail and Ringtail Den Sites and Implement Avoidance Measures BIO-MM#66: Conduct Pre-Construction Surveys for Dusky-Footed Woodrat and Implement Avoidance Measures	Less than Significant
Impact BIO#30: Loss of Roost Sites for and Direct Mortality or Disturbance of Special-Status Bats	Significant for all alternatives: The project would remove roosting habitat for pallid bat, Townsend's big-eared bat, western mastiff bat, and western red bat. Activities could also destroy or cause abandonment of occupied roost sites, if present in affected habitat.	BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#13: Implement Work Stoppage BIO-MM#67: Conduct Pre-Construction Surveys for Special-Status Bat Species BIO-MM#68: Implement Bat Avoidance and Relocation Measures BIO-MM#69: Implement Bat Exclusion and Deterrence Measures	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#31: Intermittent Disturbance of Habitat for Special-Status Plants during Operations	Significant for all alternatives: O&M activities may occasionally remove or disturb or degrade habitat for special-status plants and contribute to reduced survival of special-status plant occurrences.	BIO-MM#70: Prepare and Implement an Annual Vegetation Control Plan	Less than Significant
Impact BIO#32: Intermittent Disturbance of Habitat for and Direct Mortality of Special-Status Wildlife during Operations	Significant for all alternatives: O&M activities may occasionally remove or disturb and degrade habitat for special-status wildlife result in some areas becoming inhospitable for special-status wildlife.	BIO-MM#70: Prepare and Implement an Annual Vegetation Control Plan	Less than Significant
Impact BIO#33: Mortality of Non-Special-Status Terrestrial Wildlife	Less than significant for all alternatives: Mortality of non-special-status species is not a threshold of significance under CEQA. The project could result in mortality of non-special-status terrestrial wildlife by crushing or mangling small ground-dwelling animals hidden underground or in dense vegetation, inadvertently releasing hazardous materials into aquatic habitat, or removing vegetation and structures that support non-special-status birds and bats. However, project features to avoid or minimize impacts on special-status species will also have similar benefits in reducing impacts on common species.	No mitigation measures are required.	N/A

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#34: Removal or Degradation of Habitat for and Disturbance of Waterfowl and Shorebirds	Significant for all alternatives: The project would remove or disturb habitat for waterfowl and shorebirds in two Audubon IBAs, and could degrade habitat outside of but adjacent to the work areas.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#58: Provide Compensatory Mitigation for Impacts on Waterfowl, Shorebird, and Sandhill Crane Habitat	Less than Significant
Special-Status Plant Communities			
Impact BIO#35: Permanent Conversion or Degradation of Special-Status Plant Communities	Significant for all alternatives: The project would remove or disturb special-status plant communities, and could degrade special-status plant communities outside of but adjacent to the work areas.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#7: Conduct Botanical Surveys for Special-Status Plant Species and Special-Status Plant Communities BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#71: Restore Temporary Riparian Impacts BIO-MM#72: Provide Compensatory Mitigation for Permanent Impacts on Riparian Habitat	Less than Significant
Impact BIO#36: Intermittent Disturbance or Degradation of Special-Status Plant Communities during Operations	Significant for all alternatives: Operations activities may occasionally disturb or degrade special-status plant communities in and adjacent to the work areas.	BIO-MM#70: Prepare and Implement an Annual Vegetation Control Plan	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Aquatic Resources			
Impact BIO#37: Permanent Conversion or Degradation of Aquatic Resources Considered waters of the U.S. or waters of the State	Significant for all alternatives: The project would remove or disturb waters of the U.S. or waters of the state, including wetlands (i.e., jurisdictional aquatic resources), and could degrade aquatic resources outside of but adjacent to the project footprint.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#25: Prepare Plan for Dewatering and Water Diversions BIO-MM#71: Restore Temporary Riparian Impacts BIO-MM#72: Provide Compensatory Mitigation for Permanent Impacts on Riparian Habitat BIO-MM#73: Restore Aquatic Resources Subject to Temporary Impacts BIO-MM#74: Prepare and Implement a Compensatory Mitigation Plan for Impacts on Aquatic Resources	Less than Significant
Impact BIO#38: Permanent Conversion or Degradation of Resources Regulated under California Fish and Game Code Section 1600 et seq.	Significant for all alternatives: The project would remove or disturb resources regulated under Section 1600 et seq. (i.e., riparian and other habitat types), and may have a substantial adverse effect on fish and wildlife species.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#2: Prepare and Implement a Weed Control Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds BIO-MM#6: Establish and Implement a Compliance Reporting Program BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#25: Prepare Plan for Dewatering and Water Diversions BIO-MM#71: Restore Temporary Riparian Impacts BIO-MM#72: Provide Compensatory Mitigation for Permanent Impacts on Riparian Habitat BIO-MM#73: Restore Aquatic Resources Subject to Temporary Impacts BIO-MM#74: Prepare and Implement a Compensatory Mitigation Plan for Impacts on Aquatic Resources	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#39: Intermittent Disturbance or Degradation of Aquatic Resources during Operations	Significant for all alternatives: Operations activities may occasionally disturb or degrade aquatic resources in and adjacent to the project footprint.	BIO-MM#70: Prepare and Implement an Annual Vegetation Control Plan	Less than Significant
Protected Trees			
Impact BIO#40: Removal or Mortality of Trees Protected under Municipal Tree Ordinances	Significant for all alternatives: The project may remove or prune trees protected under municipal tree ordinances. Ground disturbance could result in increased invasive weed cover that reduces the viability and regeneration of protected trees.	BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#75: Implement Transplantation and Compensatory Mitigation for Protected Trees	Less than Significant
Impact BIO#41: Disturbance Of Trees Protected Under Municipal Tree Ordinances during Operations	Less than significant for all alternatives: Any trees within the project footprint would already have been removed. Occasional trimming of protected trees would not conflict with tree protection ordinances.	No mitigation measures are required.	N/A

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Wildlife Movement			
Impact BIO#42: Temporary Disruption of Wildlife and Wildlife Movement	Significant for all alternatives: The project would temporarily affect wildlife movement by creating temporary barriers to movement (e.g., construction fencing and dewatering), creating noise and vibration that alters or delays animal movements as they attempt to avoid the work area, and introducing artificial light during nighttime construction that alters or delays animal movements as they avoid lit areas. Temporary movement barriers could affect gene flow between animal populations and could affect the long-term persistence of populations.	BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones BIO-MM#25: Prepare Plan for Dewatering and Watering Diversions BIO-MM#76a: Minimize Impacts on Wildlife Movement during Construction BIO-MM#76b: Minimize Impacts on Wildlife Movement in the Western Pacheco Pass Region BIO-MM#79a: Provide Wildlife Movement between the Santa Cruz Mountains and Diablo Range	Less than Significant
Impact BIO#43: Permanent Impacts on Wildlife Movement	Alternatives 1, 3, and 4 Significant: The project would create a barrier to local and regional wildlife movement and fragment habitat.	BIO-MM#77a: Design Wildlife Crossings to Facilitate Wildlife Movement BIO-MM#77b: Monitoring and Adaptive Management of Wildlife Crossings BIO-MM#78: Establish Wildlife Crossings at Embankment in West Slope of Pacheco Pass BIO-MM#79a: Provide Wildlife Movement between the Santa Cruz Mountains and Diablo Range	Less than Significant
	Alternative 2 Significant: The project would create a barrier to local and regional wildlife movement and fragment habitat in the same areas as Alts. 1, 3, and 4, and would also further degrade wildlife habitat connectivity across Coyote Valley.		Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#44: Intermittent Noise Disturbance of Wildlife Using Corridors during Operations	Significant for all alternatives: noise of passing trains would cause direct impacts on large congregations of wintering waterbirds in the GEA IBA and impacts on mammalian wildlife. Increasing the speeds from 200 mph to 220 mph in the Soap Lake area, as facilitated by the TDV, would increase the distances to the various effect thresholds for bird noise impacts.	BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#58: Provide Compensatory Mitigation for Impacts on Waterfowl, Shorebird, and Sandhill Crane Habitat BIO-MM#80: Minimize Permanent Intermittent Noise, Visual, and Train Strike Impacts on Wildlife Movement	Less than Significant
Impact BIO#45: Intermittent Vibration Disturbance of Wildlife Using Corridors during Operations	Less than significant for all alternatives: Although vibration of passing trains would be perceptible to reptiles, amphibians, and small mammals, the disturbances would be brief and more frequent during daylight hours when most sensitive species are inactive.	No mitigation measures are required.	N/A
Impact BIO#46: Intermittent Visual Disturbance of Wildlife Using Corridors during Operations	Significant for all alternatives: Visual disturbance cause by passing trains would cause direct impacts on large congregations of wintering waterbirds in the GEA IBA.	BIO-MM#58: Provide Compensatory Mitigation for Impacts on Waterfowl, Shorebird, and Sandhill Crane Habitat BIO-MM#80: Minimize Permanent Intermittent Noise and Visual Impacts on Wildlife Movement	Less than Significant
Impact BIO#47: Intermittent and Permanent Lighting Disturbance of Wildlife and Wildlife Using Corridors during Operations	Significant for all alternatives: Intermittent light from passing trains and maintenance activities could alter wildlife behaviors and movement patterns.	BIO-MM#80: Minimize Permanent Intermittent Noise, Visual, and Train Strike Impacts on Wildlife Movement BIO-MM#89: Minimize the Impacts of Operational Lighting on Wildlife Species	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#48: Mortality Resulting from Train Strike during Operations	Significant for all alternatives: Operations would cause direct mortality and injury of terrestrial and aerial wildlife trying to cross the alignment.	BIO-MM#77a: Design Wildlife Crossings to Facilitate Wildlife Movement BIO-MM#80: Minimize Permanent Intermittent Noise, Visual, and Train Strike Impacts on Wildlife Movement BIO-MM#81: Minimize Permanent Intermittent Impacts on Terrestrial Species Wildlife Movement BIO-MM#82: Minimize Permanent Intermittent Impacts on Aerial Species Wildlife Movement BIO-MM#83: Implement Removal of Carrion that May Attract Condors and Eagles	Less than Significant
Impact BIO#49: Injury and Mortality Resulting from Power Line Strike during Operations	Significant for all alternatives: New power lines associated with project infrastructure could cause injury and mortality of birds.	BIO-MM#80: Minimize Permanent Intermittent Noise and Visual Impacts on Wildlife Movement BIO-MM#82: Minimize Permanent Intermittent Impacts on Aerial Species Movement	Less than Significant
Impact BIO#50: Mortality Resulting from Entrapment in OCS Poles during Operations	Less than significant for all alternatives: Minor design modification would eliminate this risk.	No mitigation measures are required.	N/A
Conservation Areas			
Impact BIO#51: Permanent Conversion or Degradation of Conservation Areas	Significant for all alternatives: The project would remove or disturb conservation area lands which contain land cover types that provide habitat for special-status species, support special-status plant communities (including riparian habitat) or aquatic resources, support wildlife movement corridors, or any combination of these and could degrade conservation area lands outside of but adjacent to the project footprint.	BIO-MM#9: Prepare and Implement a Groundwater Management Adaptive Management and Monitoring Plan BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#79a: Provide Wildlife Movement between the Santa Cruz Mountains and Diablo Range BIO-MM#84a: Avoid and Minimize Impacts on Conservation Areas BIO-MM#84b: Provide Compensatory Mitigation for Impacts on Conservation Areas	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance Before Mitigation	Mitigation Measure	CEQA Level of Significance After Mitigation
Impact BIO#52: Introduction of Invasive Species or Contaminants into Conservation Areas during Operations	Less than significant for all alternatives: Operations activities may occasionally disturb conservation area lands but such impacts would be limited in extent and duration.	No mitigation measures are required.	N/A
Habitat Conservation Plans			
Impact BIO#53: Conflict with Santa Clara Valley Habitat Plan	Significant for all alternatives: The project would have a potential conflict with Action LAND-R3 of the SCVHP.	BIO-MM#10: Prepare and Implement a Habitat Mitigation Plan for Species and Species Habitat BIO-MM#79a: Provide Wildlife Movement between the Santa Cruz Mountains and Diablo Range BIO-MM#84a: Avoid and Minimize Impacts on Conservation Areas BIO-MM#84b: Provide Compensatory Mitigation for Impacts on Conservation Areas BIO-MM#85: Provide Compensatory Mitigation for Permanent Impacts on California Sycamore Woodland at the Pacheco Creek Open Space Regional Reserve	Less than Significant
Impact BIO#54: Conflict with Santa Clara Valley Greenprint	Less than significant for all alternatives: The project would not conflict with any strategies in the Santa Clara Valley Greenprint.	No mitigation measures are required.	N/A
Impact BIO#55: Conflict with Coyote Valley Linkage	Significant for all alternatives: the project could conflict directly with provisions of an adopted habitat conservation plan.	BIO-MM#77a: Design Wildlife Crossings to Facilitate Wildlife Movement BIO-MM#77b: Monitoring and Adaptive Management of Wildlife Crossings BIO-MM#79a: Provide Wildlife Movement between the Santa Cruz Mountains and Diablo Range	Less than Significant

CCC = central California coast
CEQA = California Environmental Quality Act
EFH = essential fish habitat
GEA = Grasslands Ecological Area
HSR = high-speed rail
IBA = Important Bird Area
mph = miles per hour
N/A = not applicable
O&M = operations and maintenance
OCS = overhead contact system

SCCC = south-central California coast
SCVHP = Santa Clara Valley Habitat Plan
TDV = tunnel design variant

Impact BIO#1: Permanent Conversion or Degradation of Habitat for Special-Status Plant Species

The Authority would implement mitigation measures to reduce the impacts on special-status plants. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#7 will require the project biologist to conduct presence/absence surveys for special-status plant species and special-status plant communities within the project footprint to be avoided during construction prior to any ground-disturbing activity. BIO-MM#8 will require preparation of a plan for the salvage and relocation of any special-status plant species found during presence/absence surveys prior to ground-disturbing activity. BIO-MM#9 will involve preparation and implementation of a groundwater AMMP that will require monitoring of groundwater-dependent surface water resources (including those providing habitat for special-status plants) within the tunnel groundwater study area, providing supplemental water where needed, and remediating or compensating for any adverse effects identified during monitoring. BIO-MM#10 will involve preparation and implementation of an HMP that will require creating, preserving, restoring, or enhancing habitat for special-status species in the regional RSA to compensate for permanent and temporary impacts on species habitat; BIO-MM#11 will minimize impacts associated with mitigation efforts; and BIO-MM#12 will require compensatory mitigation for special-status plants at a 1:1 ratio. These measures will minimize direct and indirect impacts on habitat for special-status plants, provide for the avoidance or salvage and relocation of special-status plant occurrences in the project footprint, and compensate for impacts on habitat and any relocated plants. Therefore, the impact would be less than significant.

Impact BIO#2a: Permanent Conversion or Degradation of Habitat for and Mortality of Bay Checkerspot Butterfly

The Authority would implement mitigation measures to reduce the impacts on Bay checkerspot butterfly. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#14 requires identification and avoidance of Bay checkerspot butterfly host plants prior to and during construction, helping to avoid impacts on individuals. BIO-MM#15 will require preparation and implementation of a Bay Checkerspot Butterfly Protection Plan that contains measures to

maintain and improve habitat connectivity for butterflies between Coyote Ridge and Tulare Hill. BIO-MM#16 identifies minimum compensatory mitigation requirements for Bay checkerspot butterfly that will be included in the HMP developed under BIO-MM#10. These measures are expected to minimize direct and indirect impacts on Bay checkerspot butterfly habitat and individuals and will provide habitat of comparable quality to offset habitat loss. Therefore, the impact would be less than significant.

Impact BIO#2b: Permanent Conversion or Degradation of Habitat for and Mortality of Monarch Butterfly

The Authority would implement mitigation measures to reduce the impacts on monarch butterfly. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#9 will involve preparation and implementation of a GAMMP that will require monitoring of groundwater-dependent surface water resources (including those providing nectar habitat for monarchs) within the tunnel groundwater study area, providing supplemental water where needed, and remediating or compensating for any adverse effects identified during monitoring. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to special-status species. BIO-MM#14 requires identification and avoidance of Bay checkerspot and monarch butterfly host plants prior to and during construction, helping to avoid impacts on individuals. BIO-MM#86 identifies minimum compensatory mitigation requirements for monarch butterfly that will be included in the HMP developed under BIO-MM#10. These measures are expected to minimize direct and indirect impacts on monarch butterfly habitat and individuals and will provide habitat of comparable quality to offset habitat loss. Therefore, the impact would be less than significant because mortality will be minimized, and habitat will be set aside to compensate for the temporary and permanent loss of habitat available to the species.

Impact BIO#3: Permanent Conversion or Degradation of Habitat for and Mortality of Vernal Pool Crustaceans

The Authority would implement mitigation measures to reduce the impacts on vernal pool crustaceans. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. Prior to construction, the Authority will conduct pre-construction sampling for federally listed

vernal pool crustaceans consistent with USFWS survey protocols under BIO-MM#17. To avoid indirect impacts from ground-disturbing activities, the Authority will restrict activities within 250 feet of vernal pools and suitable seasonal wetlands between October 15 and April 15 as outlined in BIO-MM#18. The Authority will avoid and minimize impacts on vernal pool crustaceans within temporary impact areas as outlined in BIO-MM#19. BIO-MM#20 will require the Authority to compensate for direct and indirect (within 250 feet) impacts on vernal pool crustacean habitat at a 1:1 ratio through the HMP developed under BIO-MM#10. These measures are expected to minimize direct and indirect impacts on federally listed vernal pool crustacean habitat and individuals and to offset the loss of habitat. Therefore, the impact would be less than significant.

Impact BIO#4: Removal or Pruning of Elderberry Plants Potentially Supporting Valley Elderberry Longhorn Beetle

The Authority would implement mitigation measures to reduce the impacts on federally listed valley elderberry longhorn beetle. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#21 will avoid direct impacts on shrubs potentially occupied by valley elderberry longhorn beetle outside permanent impact areas. BIO-MM#22 identifies minimum compensatory mitigation requirements for valley elderberry longhorn beetle that will be included in the HMP developed under BIO-MM#10. These measures will minimize direct and indirect impacts on valley elderberry longhorn beetle habitat and individuals within the project footprint and compensate for loss of habitat. Therefore, the impact would be less than significant.

Impact BIO#5: Permanent Conversion or Degradation of Habitat for and Mortality of Crotch Bumble Bee

The Authority would implement mitigation measures to reduce the impacts on Crotch bumble bee. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former condition. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#12 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#23 requires sampling surveys for Crotch bumble bee in the project footprint within 1 year of construction, helping to define areas for additional pre-construction surveys. If sampling identifies occupied Crotch bumble bee habitat within the project footprint, BIO-MM#23 also requires the project biologist to conduct

pre-construction surveys of such habitat for active bee nest colonies just prior to construction so that they can be considered for avoidance through the use of no-work buffers. These measures are expected to minimize direct and indirect impacts on Crotch bumble bee habitat and individuals. BIO-MM#24 will provide habitat of comparable quality to offset habitat loss. Therefore, the impact would be less than significant.

Impact BIO#6: Permanent Conversion of Habitat for and Direct Mortality of Steelhead and Pacific Lamprey, and Permanent Conversion of Essential Fish Habitat for Pacific Coast Salmon

The Authority would implement mitigation measures to reduce the impacts on special-status fish. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones, and to document such monitoring through a compliance reporting program, respectively. BIO-MM#9 will involve preparation and implementation of a groundwater AMMP that will require monitoring of groundwater-dependent surface water resources (including those providing habitat for fish) within the tunnel groundwater study area, providing supplemental water where needed, and remediating or compensating for any adverse effects identified during monitoring. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#25 will require the preparation of a dewatering plan prior to construction in flowing water and monitoring of dewatering during construction. BIO-MM#26 will minimize direct impacts on individual special-status fish during construction by establishing procedures for rescuing stranded fish during stream dewatering. BIO-MM#27a will implement several general protection measures for fish, which will help avoid and minimize potential effects through design considerations and restoration requirements. BIO-MM#27b will minimize adverse impacts on fish by establishing work windows during sensitive periods for fish. BIO-MM#27c will help control and manage underwater sound to minimize adverse impacts from in-water pile driving. BIO-MM#28 identifies minimum compensatory mitigation requirements for steelhead that will be included in the HMP developed under BIO-MM#10; such requirements will also be expected to benefit Pacific lamprey and EFH. These measures are expected to minimize direct and indirect impacts on special-status fish habitat and individuals. Therefore, the impact would be less than significant.

Impact BIO#7: Permanent Conversion or Degradation of Habitat for and Direct Mortality of California Tiger Salamander

The Authority would implement mitigation measures to reduce the impacts on California tiger salamander. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#9 will involve preparation and implementation of a groundwater AMMP that will require monitoring of groundwater-dependent surface water resources (including those providing habitat for California tiger salamander) within the tunnel groundwater study area,

providing supplemental water where needed, and remediating or compensating for any adverse effects identified during monitoring. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#29 will minimize direct impacts on individual California tiger salamanders during construction by requiring pre-construction surveys of habitat within the project footprint. BIO-MM#30 will also minimize direct impacts on individuals by requiring WEF along the perimeter of the project footprint in suitable habitat to prevent individual salamanders from entering the work area and relocating salamanders from permanent impact areas to agency-approved habitat outside the project footprint. BIO-MM#31 identifies minimum compensatory mitigation requirements for California tiger salamander that will be included in the HMP developed under BIO-MM#10. These measures will minimize direct and indirect impacts on California tiger salamander habitat (including critical habitat) and individuals and will compensate for habitat loss. Therefore, the impact would be less than significant.

Impact BIO#8: Permanent Conversion or Degradation of Habitat for and Direct Mortality of California Red-Legged Frog

The Authority would implement mitigation measures to reduce the impacts on California red-legged frog. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#9 will involve preparation and implementation of a groundwater AMMP that will require monitoring of groundwater-dependent surface water resources (including those providing habitat for California red-legged frog) within the tunnel groundwater study area, providing supplemental water where needed, and remediating or compensating for any adverse effects identified during monitoring. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#32 will minimize direct impacts on individual California red-legged frogs during construction by requiring pre-construction surveys of modeled habitat within the project footprint and implementing additional avoidance and minimization measures (e.g., relocating frogs from permanent impact areas to agency-approved habitat outside the project footprint). BIO-MM#33 identifies minimum compensatory mitigation requirements for California red-legged frog that will be included in the HMP developed under BIO-MM#10. These measures will minimize direct and indirect impacts on California red-legged frog habitat (including critical habitat) and individuals and will compensate for habitat loss. Therefore, the impact would be less than significant.

Impact BIO#9: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Foothill Yellow-Legged Frog

The Authority would implement mitigation measures to reduce the impacts on foothill yellow-legged frog. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity.

BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#9 will involve preparation and implementation of a groundwater AMMP that will require monitoring of groundwater-dependent surface water resources (including those providing habitat for foothill yellow-legged frog) within the tunnel groundwater study area, providing supplemental water where needed, and remediating or compensating for any adverse effects identified during monitoring. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#34 will minimize direct impacts on individual foothill yellow-legged frogs during construction by requiring pre-construction surveys of modeled habitat within the project footprint and implementing additional avoidance and minimization measures (e.g., relocating frogs from permanent impact areas to agency-approved habitat outside the project footprint). BIO-MM#35 identifies minimum compensatory mitigation requirements for impacts on foothill yellow-legged frog that will be included in the HMP developed under BIO-MM#10. These measures will minimize direct and indirect impacts on foothill yellow-legged frog habitat and individuals and will compensate for habitat loss. Therefore, the impact would be less than significant.

Impact BIO#10: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Western Spadefoot

The Authority would implement mitigation measures to minimize impacts on western spadefoot and other nonlisted special-status reptiles and amphibians. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#36 and BIO-MM#37 will minimize direct impacts on individual western spadefoot and other nonlisted special-status reptiles and amphibians during construction by requiring pre-construction surveys of modeled habitat and avoidance or relocation and subsequent monitoring of observed individuals. Compensatory mitigation for impacts on aquatic resources (BIO-MM#74) is also expected to benefit western spadefoot because it breeds in vernal pools and seasonal wetlands. These measures will minimize direct and indirect impacts on western spadefoot habitat and direct impacts on individuals and will compensate for habitat loss. Therefore, the impact would be less than significant.

Impact BIO#11: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Western Pond Turtle

The Authority would implement mitigation measures to minimize impacts on western pond turtle and other nonlisted special-status reptiles and amphibians. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint

and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#9 will involve preparation and implementation of a groundwater AMMP that will require monitoring of groundwater-dependent surface water resources (including those providing habitat for western pond turtle) within the tunnel groundwater study area, providing supplemental water where needed, and remediating or compensating for any adverse effects identified during monitoring. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under FESA or CESA. BIO-MM#36 and BIO-MM#37 will minimize direct impacts on individual western pond turtles and other nonlisted special-status reptiles and amphibians during construction by requiring pre-construction surveys of modeled habitat and avoidance or relocation and subsequent monitoring of observed individuals. Compensatory mitigation for California tiger salamander (BIO-MM#31) and California red-legged frog (BIO-MM#33) is also expected to benefit western pond turtles because these species use very similar pond habitat, often co-occurring in the same ponds (pond turtles also occur in many of the same stream systems as California red-legged frogs). These measures will minimize direct and indirect impacts on western pond turtle habitat and direct impacts on individuals and will compensate for habitat loss. Therefore, the impact would be less than significant.

Impact BIO#12: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Blunt-Nosed Leopard Lizard

The Authority would implement mitigation measures to reduce the impacts on blunt-nosed leopard lizard. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#38 and BIO-MM#39 will minimize direct impacts on individual blunt-nosed leopard lizards during construction by requiring protocol-level surveys of suitable habitat to identify lizard presence within the project footprint and requiring avoidance of occupied habitat during construction. BIO-MM#40 identifies minimum compensatory mitigation requirements for blunt-nosed leopard lizard that will be included in the HMP developed under BIO-MM#10. These measures will avoid direct and indirect impacts on blunt-nosed leopard lizard individuals, will minimize loss of habitat, and will compensate for habitat loss. Therefore, the impact would be less than significant.

Impact BIO#13: Permanent Conversion or Degradation of Habitat for and Direct Mortality of San Joaquin Coachwhip, Northern California Legless Lizard, and Coast Horned Lizard

The Authority would implement mitigation measures to minimize impacts on these and other nonlisted special-status reptiles and amphibians. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#36 and BIO-MM#37 will minimize direct impacts on individuals of these species during construction by requiring pre-construction surveys of modeled habitat and avoidance or relocation and subsequent monitoring of observed individuals. These measures will minimize direct impacts on individual San Joaquin coachwhips, northern California legless lizards, and coast horned lizards. Therefore, the impact would be less than significant.

Impact BIO#14: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Giant Garter Snake

The Authority would implement mitigation measures to reduce the impacts on giant garter snake. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#41 will minimize direct impacts on individual giant garter snakes during construction by requiring avoidance of modeled aquatic habitat outside permanent impact areas, conducting work during the active season (May 1 to September 30) when snakes are expected to actively avoid danger, and conducting pre-construction surveys and monitoring prior to any work within 200 feet of aquatic habitat. BIO-MM#42 identifies minimum compensatory mitigation requirements for giant garter snake that will be included in the HMP developed under BIO-MM#10. These measures will minimize direct and indirect impacts on giant garter snake habitat and individuals and will compensate for habitat loss. Therefore, the impact would be less than significant.

Impact BIO#15: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Short-Eared Owl and Grasshopper Sparrow

The Authority would implement mitigation measures to minimize impacts on these and other nonlisted special-status birds. BIO-MM#1 will involve preparation of an RRP that will identify and

describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#43 will require the project biologist to conduct pre-construction surveys for nesting non-raptor bird species within the project footprint and delineate no-work buffers around active nests. Compensatory mitigation for Bay checkerspot butterfly (BIO-MM#16), California tiger salamander upland habitat (BIO-MM#31), and San Joaquin kit fox (BIO-MM#61) is also expected to benefit short-eared owl and grasshopper sparrow because these species use very similar grassland habitat. These measures will minimize direct and indirect impacts on short-eared owl and grasshopper sparrow habitat and direct impacts on individuals and will compensate for habitat loss. Therefore, the impact would be less than significant.

Impact BIO#16: Permanent Conversion or Degradation of Habitat for Mountain Plover and Disturbance of Mountain Plover and Western Snowy Plover

The Authority would implement mitigation measures to minimize impacts on mountain plover and western snowy plover. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#43 will require the project biologist to conduct pre-construction surveys for nesting non-raptor bird species within the project footprint and delineate no-work buffers around active nests. BIO-MM#44 will avoid disturbance of wintering mountain plovers by requiring the Authority to identify wintering sites from October 1 to December 31 and maintaining a 250-foot buffer from such sites from January 1 to March 15 (alternatively, the Authority may prohibit all construction within 250 feet of modeled habitat from October 1 to March 15). These measures will minimize direct and indirect impacts on mountain plover and western snowy plover habitat and will avoid direct impacts on western snowy plover individuals. Therefore, the impact would be less than significant.

Impact BIO#17: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Burrowing Owl

The Authority would implement mitigation measures to minimize impacts on burrowing owl. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to

develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#45 and BIO-MM#46 will require habitat surveys of modeled habitat to confirm presence/absence of suitable burrows in the project footprint and subsequent pre-construction surveys for and avoidance of occupied burrows during construction. BIO-MM#47 identifies compensatory mitigation requirements for occupied breeding habitat that will be included in the HMP developed under BIO-MM#10. These measures will minimize direct and indirect impacts on burrowing owl habitat and individuals and will compensate for habitat loss. Therefore, the impact would be less than significant.

Impact BIO#18: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Golden Eagle and Bald Eagle

The Authority would implement mitigation measures to reduce the impacts on habitat for golden eagle and bald eagle and avoid direct impacts on individuals. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to establish roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#48 and BIO-MM#49 will prevent destruction and disturbance of active nests during construction by requiring pre-construction surveys of modeled nesting habitat within the project footprint and establishing exclusion zones around active nests. BIO-MM#50 will compensate for the removal of any nests (if necessary) by requiring the preparation and implementation of a nest relocation or replacement plan for affected eagle pairs in consultation with the USFWS and local eagle experts. These measures will avoid direct and indirect impacts on golden eagle and bald eagle habitat and direct impacts on individuals. Therefore, the impact would be less than significant.

Impact BIO#19: Injury or Disturbance of California Condor

The Authority would implement mitigation measures to reduce the impacts on California condor. BIO-MM#5 will require the project biologist to restrict vehicle traffic to established roads, construction areas, and other permissible areas, and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#6 will require the project biologist to document compliance with all IAMFs and MMs through a compliance reporting program. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#51 will implement an array of avoidance and minimization measures during construction to prevent disturbance, injury, and mortality of condors. These measures will avoid direct and indirect impacts on California condor individuals. Therefore, the impact would be less than significant.

Impact BIO#20: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Special-Status Raptors (American Peregrine Falcon, Northern Harrier, White-Tailed Kite) and Other Raptors

The Authority would implement mitigation measures to reduce the impacts on special-status raptors. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to establish roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#52 will prevent destruction and disturbance of active nests during construction by requiring pre-construction surveys of modeled nesting habitat within the project footprint and establishing exclusion zones around active nests. This measure will minimize direct impacts on individuals. Therefore, the impact would be less than significant.

Impact BIO#21: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Swainson's Hawks

The Authority would implement mitigation measures to reduce the impacts on Swainson's hawk. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#53 and BIO-MM#54 will prevent destruction and disturbance of active nests during construction by requiring pre-construction surveys of modeled nesting habitat in and within 0.5 mile of the project footprint and establishing exclusion zones around and monitoring of active nests. BIO-MM#55 identifies minimum compensatory mitigation requirements for Swainson's hawk that will be included in the HMP developed under BIO-MM#10. These measures will minimize direct and indirect impacts on Swainson's hawk suitable habitat and direct impacts on individuals and will compensate for habitat loss. Therefore, the impact would be less than significant.

Impact BIO#22: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Purple Martin, Olive-Sided Flycatcher, and Loggerhead Shrike

The Authority would implement mitigation measures to minimize impacts on these and other nonlisted special-status birds. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#43 will require the project biologist to conduct pre-construction surveys for nesting non-raptor bird species within the project

footprint and delineate no-work buffers around active nests. This measure will minimize or avoid direct impacts on individuals. Therefore, the impact would be less than significant.

Impact BIO#23: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Least Bell's Vireo, Yellow Warbler, and Yellow-Breasted Chat

The Authority would implement mitigation measures to minimize impacts on these species. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#9 will involve preparation and implementation of a groundwater AMMP that will require monitoring of groundwater-dependent surface water resources (including riparian habitat) within the tunnel groundwater study area, providing supplemental water where needed, and remediating or compensating for any adverse effects identified during monitoring. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#43 will require the project biologist to conduct pre-construction surveys for nesting non-raptor bird species within the project footprint and delineate no-work buffers around active nests. Compensatory mitigation for riparian habitat (BIO-MM#72) will benefit these species because it will require creating, preserving, restoring, or enhancing riparian plant communities in which they nest. These measures will minimize direct and indirect impacts on suitable habitat for these species and direct impacts on individuals. Therefore, the impact would be less than significant.

Impact BIO#24: Permanent Conversion or Degradation of Habitat for and Direct Mortality or Disturbance of Tricolored Blackbird and Yellow-Headed Blackbird

The Authority would implement mitigation measures to minimize impacts on these species. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#9 will involve preparation and implementation of a groundwater AMMP that will require monitoring of groundwater-dependent surface water resources (including those providing habitat for tricolored blackbird and yellow-headed blackbird) within the tunnel groundwater study area, providing supplemental water where needed, and remediating or compensating for any adverse effects identified during monitoring. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#56 will avoid direct impacts on nesting tricolored blackbirds during construction by requiring pre-construction surveys for and avoidance of nest colonies within 300

feet of work areas. BIO-MM#57 identifies minimum compensatory mitigation requirements for tricolored blackbird that will be included in the HMP developed under BIO-MM#10. Compensatory mitigation for aquatic resources (BIO-MM#74) is also expected to benefit these species because it will require creating, preserving, restoring, or enhancing freshwater marsh habitat in which they nest. These measures will minimize direct and indirect impacts on suitable habitat for these species and direct impacts on individuals and will compensate for habitat loss. Therefore, the impact would be less than significant.

Impact BIO#25: Permanent Conversion or Degradation of Habitat for and Disturbance of Sandhill Crane

The Authority would implement mitigation measures to minimize impacts on sandhill crane. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#44 will avoid disturbance of sandhill crane roosts by requiring the Authority to identify roost sites from October 1 to December 31 and maintain a 0.75-mile buffer from such sites in which no nighttime work will be conducted from January 1 to March 15 (alternatively, the Authority may prohibit all construction within 0.75 mile of modeled habitat from October 1 to March 15). BIO-MM#58 identifies minimum compensatory mitigation requirements for waterfowl, shorebird, and sandhill crane habitat that will be included in the HMP developed under BIO-MM#10. These measures will minimize direct disturbance impacts and avoid direct impacts on sandhill crane individuals and compensate for loss and degradation of roosting habitat. Therefore, the impact would be less than significant.

Impact BIO#26a: Loss of Breeding, Foraging, and Dispersal Habitat for and Direct Mortality or Disturbance of Mountain Lion

The Authority would implement mitigation measures to reduce the impacts on mountain lion. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to special-status species. BIO-MM#87 will minimize direct impacts on individual mountain lions during construction by identifying and avoiding occupied mountain lion dens within the project footprint. BIO-MM#88 identifies minimum compensatory mitigation

requirements for mountain lion that will be included in the HMP developed under BIO-MM#10. These measures will minimize direct and indirect impacts on mountain lion suitable habitat and individuals and will compensate for habitat loss. Therefore, the impact would be less than significant because mortality will be minimized, and habitat will be set aside to compensate for the temporary and permanent loss of habitat available to the species.

Impact BIO#26b: Loss of Denning and Dispersal Habitat for and Direct Mortality or Disturbance of San Joaquin Kit Fox

The Authority would implement mitigation measures to reduce the impacts on San Joaquin kit fox. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#59 and BIO-MM#60 will minimize direct impacts on individual San Joaquin kit foxes during construction by identifying and avoiding occupied kit fox dens within the project footprint and requiring contractors to inspect construction site materials for kit foxes before burying, capping, or moving them. BIO-MM#61 identifies minimum compensatory mitigation requirements for San Joaquin kit fox that will be included in the HMP developed under BIO-MM#10. These measures will minimize direct and indirect impacts on San Joaquin kit fox suitable habitat and individuals and will compensate for habitat loss. Therefore, the impact would be less than significant.

Impact BIO#27: Permanent Conversion or Degradation of Habitat for and Direct Mortality of Fresno Kangaroo Rat

The Authority would implement mitigation measures to reduce the impacts on Fresno kangaroo rat. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#13 will give the project biologist authority to halt any construction activities that could injure or kill individuals belonging to species listed under the FESA or CESA. BIO-MM#62 will avoid direct impacts on individual Fresno kangaroo rats during construction by requiring surveys of modeled habitat to confirm presence/absence of suitable burrows in the project footprint and subsequent pre-construction surveys for and avoidance of occupied burrows. BIO-MM#63 identifies minimum compensatory mitigation requirements for Fresno kangaroo rat that will be included in the HMP developed under BIO-MM#10. These measures will minimize direct and indirect impacts on

Fresno kangaroo rat suitable habitat and direct impacts on individuals and will compensate for habitat loss. Therefore, the impact would be less than significant.

Impact BIO#28: Permanent Conversion or Degradation of Habitat for and Direct Mortality of American Badger

The Authority would implement mitigation measures to reduce the impacts on American badger. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#13 will allow the Project Biologist to halt work if any badgers are encountered that could be injured or killed by project activities. BIO-MM#64 will avoid direct impacts on individual American badgers during construction by requiring pre-construction surveys for and avoidance of occupied dens. These measures are expected to avoid direct impacts on individual American badgers. Therefore, the impact would be less than significant.

Impact BIO#29: Permanent Conversion or Degradation of Habitat for and Direct Mortality of San Francisco Dusky-Footed Woodrat and Ringtail

The Authority would implement mitigation measures to reduce the impacts on these species. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#13 will allow the Project Biologist to halt work if any woodrats or ringtails are encountered that could be injured or killed by project activities. BIO-MM#65 and BIO-MM#66 will avoid direct impacts on individual ringtails and dusky-footed woodrats, respectively, by requiring pre-construction surveys for and avoidance of ringtail dens and dusky-footed woodrat stick houses where modeled habitat overlaps with the project footprint. Compensatory mitigation for riparian habitat (BIO-MM#72) will benefit these species because they both occur in riparian plant communities with dense understory. These measures are expected to avoid direct and indirect impacts on ringtail and San Francisco dusky-footed woodrat habitat and direct impacts on individuals and to compensate for habitat loss. Therefore, the impact would be less than significant.

Impact BIO#30: Loss of Roost Sites for and Direct Mortality or Disturbance of Special-Status Bats

The Authority would implement mitigation measures to reduce the impacts on special-status bats. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones

(including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones, and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to establish roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#13 will allow the Project Biologist to halt work if any special-status bats are encountered that could be injured or killed or whose roosts could be disrupted by project activities. BIO-MM#67 to BIO-MM#69 will avoid direct impacts on individual special-status bats by requiring pre-construction surveys for and avoidance, exclusion, or relocation of active hibernacula, maternity roosts, or nurseries in or within 500 feet of the project footprint. These measures are expected to minimize or avoid direct impacts on individuals. Therefore, the impact would be less than significant.

Impact BIO#31: Intermittent Disturbance and Degradation of Habitat for Special-Status Plants during Operations

The Authority would implement BIO-MM#70 to reduce the impact on special-status plant habitat during operations. This measure will require the Authority to prepare an annual VCP to address vegetation removal for maintaining clear areas around facilities and controlling invasive weeds during the operational phase and will limit herbicide use to products approved by Caltrans. By establishing controls on the types of herbicides used for vegetation management and defining the situations in which herbicides are and are not an appropriate control method, VCPs are expected to minimize direct and indirect impacts on special-status plant habitat from herbicide drift. Combined with the intermittent and widely dispersed nature of effects from inspection and maintenance activities, the impact on plant habitat would be less than significant.

Impact BIO#32: Intermittent Disturbance or Degradation of Habitat for Special-Status Wildlife during Operations

The Authority would implement BIO-MM#70 to reduce the impact on special-status wildlife habitat during operations. This measure will require the Authority to prepare an annual VCP to address vegetation removal for maintaining clear areas around facilities and controlling invasive weeds during the operational phase and will limit herbicide use to products approved by Caltrans. By establishing controls on the types of herbicides used for vegetation management and defining the situations in which herbicides are and are not an appropriate control method, VCPs are expected to minimize direct and indirect impacts on special-status wildlife habitat from herbicide drift. Combined with the intermittent and widely dispersed nature of effects from inspection and maintenance activities, the impact would be less than significant.

Impact BIO#34: Removal or Degradation of Habitat for and Disturbance of Waterfowl and Shorebirds

The Authority would implement mitigation measures to reduce the impacts on waterfowl and shorebirds. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-

disturbing activity. BIO-MM#58 identifies minimum compensatory mitigation requirements for waterfowl and shorebird habitat that will be included in the HMP developed under BIO-MM#10. BIO-MM#P1 will require the Authority to conserve habitat in and adjacent to the GEA which will benefit waterfowl and shorebirds. These measures will minimize direct and indirect impacts on waterfowl and shorebird individuals and habitat and will compensate for habitat loss. Therefore, the impact would be less than significant.

Impact BIO#35: Permanent Conversion or Degradation of Special-Status Plant Communities

The Authority would implement mitigation measures to reduce the impacts on special-status plant communities. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#7 will require the project biologist to conduct presence/absence surveys for special-status plant species and special-status plant communities within the project footprint to be avoided during construction prior to any ground-disturbing activity. HYD-MM#1 will reduce groundwater flows associated with tunnel construction. BIO-MM#9 will involve preparation and implementation of a groundwater AMMP that will require monitoring of groundwater-dependent surface water resources (including those providing habitat for special-status plant communities) within the tunnel groundwater study area, providing supplemental water where needed, and remediating or compensating for any adverse effects identified during monitoring. Under BIO-MM#71, the RRP will require contractors to begin revegetation of temporarily affected riparian areas within 90 days of construction completion. BIO-MM#72 identifies minimum compensatory mitigation requirements for riparian habitat. These measures are expected to minimize temporary impacts and compensate for permanent impacts on special-status plant communities by restoring, preserving, creating, or enhancing riparian communities of equivalent or greater ecological integrity than those affected. Therefore, the impact would be less than significant.

Impact BIO#36: Intermittent Disturbance or Degradation of Special-Status Plant Communities during Operations

The Authority would implement BIO-MM#70 to reduce the impact on special-status plant communities during operations. This measure will require the Authority to prepare an annual VCP to address vegetation removal for maintaining clear areas around facilities and controlling invasive weeds during the operational phase and will limit herbicide use to products approved by Caltrans. By establishing controls on the types of herbicides used for vegetation management and defining the situations in which herbicides are and are not an appropriate control method, VCPs are expected to minimize direct and indirect impacts on special-status plant communities from herbicide drift. Combined with the intermittent and widely dispersed nature of effects from inspection and maintenance activities, the impact would be less than significant.

Impact BIO#37: Permanent Conversion or Degradation of Aquatic Resources Considered Jurisdictional under Clean Water Act Section 404 or by the State

The Authority would implement mitigation measures to reduce the impacts on aquatic resources. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project

biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#9 will involve preparation and implementation of a groundwater AMMP that will require monitoring of groundwater-dependent surface water resources within the tunnel groundwater study area, providing supplemental water where needed, and remediating or compensating for any adverse effects identified during monitoring. Under BIO-MM#71, the RRP will require contractors to begin revegetation of temporarily affected riparian areas within 90 days of construction completion. BIO-MM#72 identifies minimum compensatory mitigation requirements for riparian habitat. BIO-MM#73 will minimize temporary impacts on aquatic resources by requiring contractors to begin restoration of temporarily disturbed features within 90 days of completing construction. BIO-MM#25 will require the Authority to prepare a dewatering plan that incorporates measures to minimize turbidity and siltation of downstream waters. BIO-MM#74 requires preparation and implementation of a CMP for impacts on aquatic resources under CWA Section 404 jurisdiction. These measures are expected to avoid or minimize temporary impacts and compensate for permanent impacts on aquatic resources. Therefore, the impact would be less than significant.

Impact BIO#38: Permanent Conversion or Degradation of Resources Regulated under California Fish and Game Code Section 1600 et seq.

The Authority would implement mitigation measures to reduce the impacts on fish and wildlife resources protected under Section 1600 et seq. BIO-MM#1 will involve preparation of an RRP that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#2 will require the project biologist to develop a WCP prior to ground-disturbing activity to minimize and avoid the spread of invasive weeds into the project footprint and adjacent areas. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#4 and BIO-MM#6 will require the project biologist to monitor construction activities for compliance with avoidance and minimization measures and established ESAs and nondisturbance zones and to document such monitoring through a compliance reporting program, respectively. BIO-MM#5 will require the project biologist to establish vehicle speed limits within the project footprint; restrict vehicle traffic to established roads, construction areas, and other permissible areas; and direct that routes be marked to prevent off-road traffic prior to ground-disturbing activity. BIO-MM#9 will involve preparation and implementation of a groundwater AMMP that will require monitoring of groundwater-dependent surface water resources within the tunnel groundwater study area, providing supplemental water where needed, and remediating or compensating for any adverse effects identified during monitoring. Under BIO-MM#71, the RRP will require contractors to begin revegetation of temporarily affected riparian areas within 90 days of construction completion. BIO-MM#72 identifies minimum compensatory mitigation requirements for riparian habitat. BIO-MM#73 will minimize temporary impacts on aquatic resources by requiring contractors to begin restoration of temporarily disturbed features within 90 days of completing construction. BIO-MM#25 will require the Authority to prepare a dewatering plan that incorporates measures to minimize turbidity and siltation of downstream waters. BIO-MM#74 requires preparation and implementation of a CMP for impacts on aquatic resources under CWA Section 404 jurisdiction, which will also benefit fish and wildlife resources under Cal. Fish and Game Code Section 1600 et seq. where they overlap with CWA Section 404 resources and waters of the state. These measures are expected to minimize temporary impacts

and compensate for permanent impacts on aquatic and other related resources. Therefore, the impact would be less than significant.

Impact BIO#39: Intermittent Disturbance or Degradation of Aquatic Resources during Operations

The Authority would implement BIO-MM#70 to reduce the impact on aquatic resources during operations. This measure will require the Authority to prepare an annual VCP to address vegetation removal for maintaining clear areas around facilities and controlling invasive weeds during the operational phase and will limit herbicide use to products approved by Caltrans. By establishing controls on the types of herbicides used for vegetation management and defining the situations in which herbicides are and are not an appropriate control method, VCPs are expected to minimize direct and indirect impacts on aquatic resources from herbicide drift. Combined with the intermittent and widely dispersed nature of effects from inspection and maintenance activities, the impact would be less than significant.

Impact BIO#40: Removal or Mortality of Trees Protected under Municipal Tree Ordinances

The Authority would implement mitigation measures to reduce the impacts on protected trees. BIO-MM#75 will avoid or minimize direct and indirect impacts on protected trees during construction by requiring the identification and avoidance of protected trees in and adjacent to the project footprint prior to construction. This measure will also compensate for removal of protected trees by requiring the Authority to prepare and implement a transplanted tree monitoring and maintenance plan. BIO-MM#9 will involve preparation and implementation of a groundwater AMMP that will require monitoring of groundwater-dependent surface water resources within the tunnel groundwater study area, providing supplemental water where needed, and remediating or compensating for any adverse effects identified during monitoring. These measures will minimize and compensate for impacts on protected trees. Therefore, the impact would be less than significant.

Impact BIO#42: Temporary Disruption of Wildlife and Wildlife Movement

The Authority would implement mitigation measures to reduce temporary impacts on wildlife movement during construction. BIO-MM#3 will require the project biologist to establish ESAs and nondisturbance zones (including WEF, where applicable) that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures prior to ground-disturbing activity. BIO-MM#25 will require the Project Biologist to conduct pre-activity surveys for and relocate (consistent with regulatory authorizations) any special-status wildlife occurring in waterbodies affected by dewatering or water diversion activities. BIO-MM#76a will require the Authority to avoid placing temporary fencing within known wildlife corridors in portions of the project footprint where the tracks are elevated and will require the design to consider methods that will facilitate wildlife use of crossings. It will also minimize the effects of noise, light, and vibration on individuals moving through or near the project footprint. BIO-MM#76b will require the Authority to facilitate wildlife movement around project construction activities, minimizing the temporary disruption of wildlife movement in the western Pacheco Pass region. These measures will minimize direct and indirect impacts on wildlife moving near or across the project footprint during construction. Therefore, the impact would be less than significant.

Impact BIO#43: Permanent Impacts on Wildlife Movement

The Authority would implement mitigation measures to reduce permanent impacts on wildlife movement. BIO-MM#78 will require the Authority to create dedicated wildlife crossing structures in portions of the project footprint where wildlife movement would be significantly reduced. BIO-MM#77a will also provide for extended viaducts for wildlife movement and dedicated wildlife underpasses that meet design specifications for the species affected, while BIO-MM#77b will provide for monitoring and adaptive management of wildlife crossings to facilitate their use by wildlife. BIO-MM#79a will partially compensate for permanent impacts on wildlife movement by requiring the Authority to protect lands in perpetuity within the Santa Cruz to Gabilan Wildlife Linkage or Soap Lake floodplain. BIO-MM#79b will require the Authority to work with stakeholders and wildlife agencies to implement an overcrossing to facilitate movement between

the Diablo Range and the Inner Coast Range. These measures are expected to minimize and compensate for direct and indirect impacts on wildlife corridor connectivity and individuals moving near or across the rail alignment. Therefore, the impact would be less than significant.

Impact BIO#44: Intermittent Noise Disturbance of Wildlife Using Corridors during Operations

The Authority would implement BIO-MM#58 to compensate for noise impacts on shorebirds and wintering waterbirds, and BIO-MM#80 to avoid and minimize impacts from noise, or some combination of the two measures if necessary. BIO-MM#58 will avoid or minimize noise impacts on habitat or provide for the preservation and enhancement of waterbird habitat in the GEA and UPR IBAs to compensate for the reduction in caloric uptake experienced in habitat close to the railroad. BIO-MM#80 is expected to reduce or eliminate noise effects on wildlife, including mountain lion and San Joaquin kit fox, by requiring sound walls within specific locations important for movement. This conclusion also considers the fact that there is less operational activity at night during periods of generally higher mammal activity. BIO-MM#P1 will further compensate for effects by requiring the Authority to conserve lands in and adjacent to the GEA. Therefore, the impact would be less than significant.

Impact BIO#46: Intermittent Visual Disturbance of Wildlife Using Corridors during Operations

The Authority would implement mitigation measures to compensate for visual disturbance impacts on wintering waterbirds and some species of nesting raptors. BIO-MM#58 will provide for the preservation and enhancement of waterbird habitat in the GEA and UPR IBAs to compensate for the reduction in caloric uptake experienced in habitat close to the railroad, although this measure will not eliminate disturbance of wintering waterbirds in the GEA or UPR IBAs. BIO-MM#80 will require construction of a noise barrier in the UPR EBA and an enclosure in the GEA IBA. These measures are expected to reduce or eliminate effects on wildlife using corridors. Therefore, the impact would be less than significant.

Impact BIO#47: Intermittent and Permanent Lighting Disturbance of Wildlife and Wildlife Using Corridors during Operations

The Authority would implement mitigation to minimize ALAN impacts on wildlife from operations. Impacts from artificial lighting during operations are limited to areas with existing low levels of ALAN, primarily the Coyote Valley area, and areas east of Gilroy. BIO-MM#89 will help to minimize the impacts of ALAN within these areas by minimizing the intensity and duration of operational lighting of permanent facilities, thereby minimizing light spillover into adjacent wildlife habitat. BIO-MM#89 will also avoid shorter wavelengths of light on train headlights, which will reduce effects on melatonin metabolism and avoidance responses of wildlife. Lastly, BIO-MM#80, although primarily designed to reduce noise effects, will also help to minimize intermittent lighting of wildlife habitat from train headlights by requiring the construction of opaque noise/visual barriers, which will obscure headlights, at essential wildlife crossings in the Coyote Valley, in the upper Pacheco Creek area, and at the crossing of the California Aqueduct. Collectively, these measures will reduce or eliminate lighting effects on wildlife and wildlife using corridors during operations. Therefore, the impact would be less than significant.

Impact BIO#48: Mortality Resulting from Train Strike during Operations

The Authority would implement mitigation measures to reduce mortality of wildlife using corridors. BIO-MM#77a will require implementation of an array of design features pertaining to wildlife crossings to minimize mortality of terrestrial wildlife. BIO-MM#80 will require the implementation of a noise barrier within the UPR IBA and an enclosure within the GEA IBA. These measures will substantially reduce the potential for train strike within the UPR IBA, and will eliminate the risk of train strike within the GEA IBA. BIO-MM#81 will require the installation of a barrier (e.g., flashing, fine-mesh fencing, slats, or other feature buried at least 12 inches below-ground and 12 inches aboveground) along portions of the permanent security fencing adjacent to natural habitats to prevent reptiles, amphibians, and mammals from moving through or underneath the fencing to

access the right-of-way where they could be killed by moving trains. BIO-MM#82 will implement features to minimize or avoid mortality of birds and bats. BIO-MM#83 will involve carcass removal from the guideway to reduce risk of attracting eagles and condors. These measures are expected to minimize or avoid direct impacts on wildlife movement during project operations. Therefore, the impact would be less than significant.

Impact BIO#49: Injury and Mortality Resulting from Power Line Strike during Operations

The Authority would implement mitigation measures to reduce mortality of wildlife using corridors. BIO-MM#80 will require installation of an enclosure in the GEA IBA and installation of noise barriers in the UPR IBA to reduce or avoid the potential for power line strike during operations. BIO-MM#82 will also specify design features for the OCS that will minimize or avoid power line strike during operations. These measures are expected to minimize direct impacts on wildlife movement during project operations. Therefore, the impact would be less than significant.

Impact BIO#51: Permanent Conversion or Degradation of Conservation Areas

The Authority would implement BIO-MM#84a, which would help to avoid and minimize effects on conservation areas, and BIO-MM#84b, which would provide compensatory habitat to replace the permanent loss of habitat commensurate with the land cover type and ecological function of the lands lost. This measure will require the Authority to consult with the USFWS, CDFW, and other organizations that hold conservation easements affected by the project when developing the HMP under BIO-MM#10. BIO-MM#9 will involve preparation and implementation of a groundwater AMMP that will require monitoring of groundwater-dependent surface water resources within the tunnel groundwater study area, providing supplemental water where needed, and remediating or compensating for any adverse effects identified during monitoring. In addition, per BIO-MM#84b, the Authority will compensate affected organizations for any temporal complications resulting from the permanent loss of a conservation area. These measures will offset the loss of habitat and ecological function in conservation areas, including the conversion of lands to HSR track and systems. Therefore, the impact would be less than significant.

Impact BIO#53: Conflict with Santa Clara Valley Habitat Plan

The Authority would implement BIO-MM#85 to reduce impacts on the SCVHP. This measure will require the Authority to partner with the SCVHA to identify and conserve the additional acres of central California sycamore woodland necessary to meet the goals of the SCVHP when developing the HMP under BIO-MM#10 and to address the impacts on the Pacheco Creek Open Space Regional Reserve. These measures are expected to compensate for the potential conflict at the Pacheco Creek Open Space Regional Reserve by replacing habitat lost at the reserve with habitat in an appropriate similarly sized patch size. Therefore, the impact would be less than significant.

3.7.11 Federal Endangered Species Act Findings

In addition to various technical reports prepared for the project, a BA was prepared and submitted to the USFWS and NMFS for review in early 2020 (the BA was subsequently revised and resubmitted in October 2020 to address NMFS comments). The BA evaluated the potential adverse effects of the project (i.e., proposed action) on species listed as endangered or threatened under FESA, as well as potential effects on designated critical habitat. NMFS subsequently issued their biological opinion and completed consultation on June 24, 2021. The Authority has continued to consult with the USFWS since that time and submitted revised determinations for several federally listed species on the basis of that consultation. Issuance of a biological opinion from the USFWS is expected prior to the Record of Decision.

Based on the evaluation of potential effects of the proposed action prior to implementation of IAMFs and mitigation measures, as well as the biological opinion from NMFS, and ongoing consultation with the USFWS, the Authority has determined that the project could have effects on species and critical habitat as shown in Table 3.7-28.

Table 3.7-28 Summary of Effects for Federally Listed Species and their Critical Habitat

Scientific Name Common Name	Federal Status	Species Determination	Critical Habitat Determination
Plants			
Castilleja affinis var. *neglecta* Tiburon paintbrush	FE	Not likely to adversely affect	N/A
Ceanothus ferrisiae Coyote ceanothus	FE	Not likely to adversely affect	N/A
Chloropyron palmatum Palmate-bracted bird's-beak	FE	No effect	N/A
Dudleya abramsii ssp. setchellii Santa Clara Valley dudleya	FE	May affect, and is likely to adversely affect	N/A
Euphorbia hooveri Hoover's spurge	FT	No effect	No Effect
Neostapfia colusana Colusa grass	FT	No effect	No Effect
Orcuttia inaequalis San Joaquin Orcutt grass	FT	No effect	No Effect
Orcuttia pilosa Hairy Orcutt grass	FE	No effect	No Effect
Streptanthus albidus ssp. albidus Metcalf Canyon jewelflower	FE	May affect, and is likely to adversely affect	N/A
Tuctoria greenei Greene's tuctoria	FE	No effect	No Effect
Invertebrates			
Euphydryas editha bayensis Bay checkerspot butterfly	FT	May affect, and is likely to adversely affect	Likely to Adversely Affect
Branchinecta conservatio Conservancy fairy shrimp	FE	No effect	No Effect
Branchinecta longiantenna Longhorn fairy shrimp	FE	No effect	No Effect
Branchinecta lynchi Vernal pool fairy shrimp	FT	May affect, and is likely to adversely affect	No Effect
Lepidurus packardi Vernal pool tadpole shrimp	FT	May affect, and is likely to adversely affect	No Effect
Desmocerus californicus dimorphus Valley elderberry longhorn beetle	FT	May affect, and is likely to adversely affect	N/A

Scientific Name Common Name	Federal Status	Species Determination	Critical Habitat Determination
Fish			
Oncorhynchus mykiss Steelhead—central California coast DPS	FT	May affect, and is likely to adversely affect	Likely to Adversely Affect
Oncorhynchus mykiss Steelhead—south-central California coast DPS	FT	May affect, and is likely to adversely affect	Likely to Adversely Affect
Oncorhynchus mykiss Steelhead—California Central Valley DPS	FT	Not likely to adversely affect	No Effect
Amphibians			
Rana draytonii California red-legged frog	FT	May affect, and is likely to adversely affect	Likely to Adversely Affect
Ambystoma californiense California tiger salamander	FT	May affect, and is likely to adversely affect	Likely to Adversely Affect
Reptiles			
Gambelia sila Blunt-nosed leopard lizard[1]	FE	Not likely to adversely affect	N/A
Thamnophis gigas Giant garter snake	FT	Not likely to adversely affect	N/A
Birds			
Gymnogyps californianus California condor[1]	FE	Not likely to adversely affect	No Effect
Vireo bellii pusillus Least Bell's vireo	FE	May affect, and is likely to adversely affect	No Effect
Mammals			
Dipodomys nitratoides exilis Fresno kangaroo rat	FE	No effect	No Effect
Vulpes macrotis mutica San Joaquin kit fox	FE	Not likely to adversely affect	N/A

DPS = distinct population segment
FE = federally endangered
FT = federally threatened
[1] California Fish and Game Code Fully Protected Species